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Eugene B. Power

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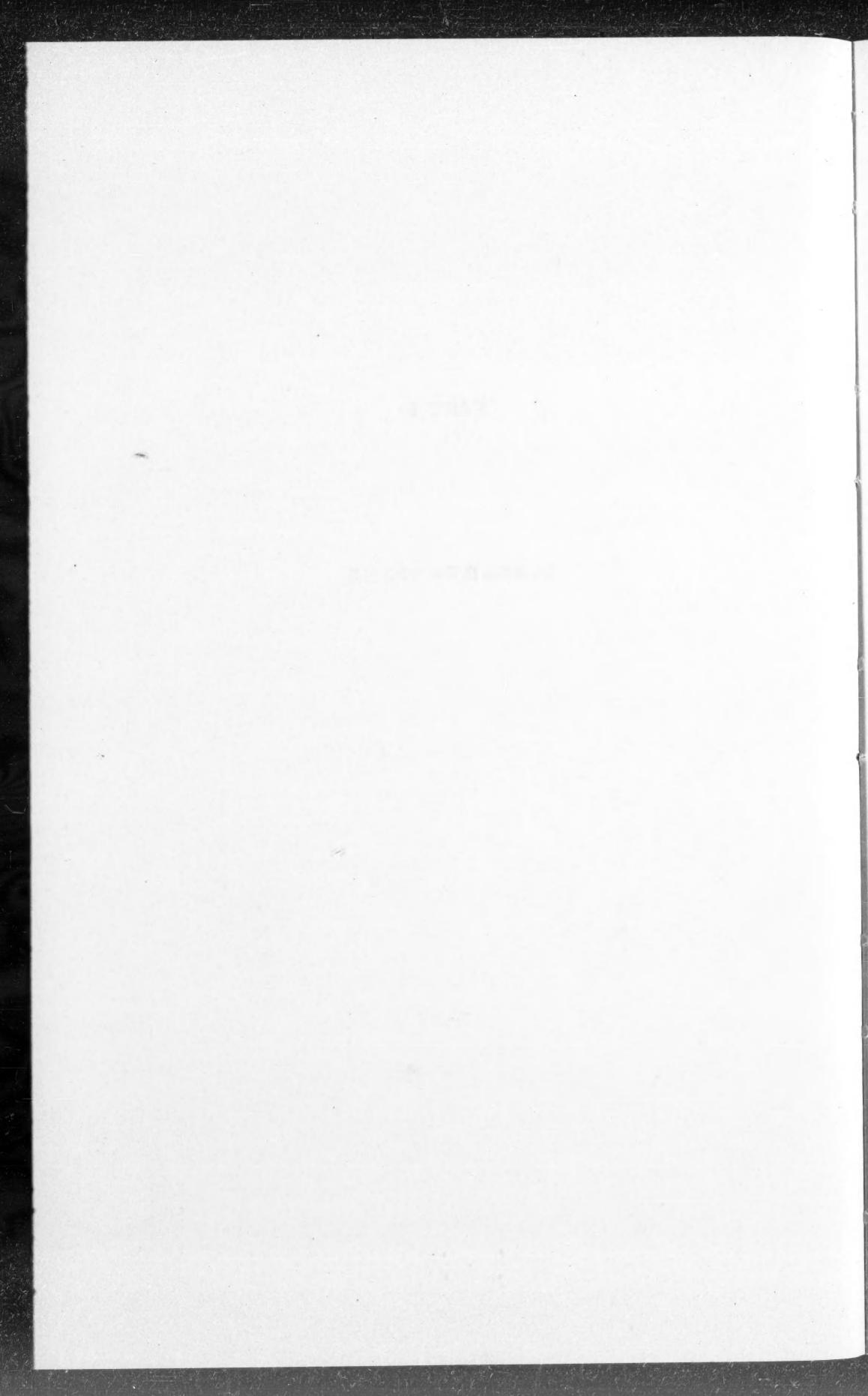
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#### PART I

DISSERTATIONS



## RIGOROUS SOLUTIONS OF THE PRANDTL INTEGRAL EQUATION FOR A CERTAIN CLASS OF AIRFOILS

(Publication No. 1180)\*

Hideo Yoshihara, Ph. D. University of Michigan, 1945

The problem of the spanwise lift distribution for finite wings (Incompressible case) is solved for certain planforms with given twist conditions along the span using a method introduced by Dr. Otto Laporte (Reference 1).

The basis of the Laporte method lies basically upon a potential theory approach introduced by Trefftz (Reference 2). The potential field due to the trailing vortices from the wing is analyzed at a large distance behind the wing. Here the flow may be considered as two-dimensional in the complex plane u = y + iz, y being in the direction of the span of the wing and z normal to it. The velocity potential  $\emptyset(y,z)$  is produced by the system of trailing vortices whose projection upon the u-plane forms a line of discontinuity (a slit) on the y-axis from -b/2 to b/2 where b is the span of the wing. The potential  $\emptyset(y,z)$  is now determined from the equation

$$\frac{\partial^2 \emptyset}{\partial v^2} + \frac{\partial^2 \emptyset}{\partial z^2} = 0 \tag{1}$$

3

with the boundary conditions

$$-\left(\frac{\partial \emptyset}{\partial z}\right)_{z=0}^{+} \frac{\partial \emptyset(y,0)}{mc(y)} = V \alpha(y)$$
 (2)

where the plus sign is to be taken on the upper side of the slit, while the negative sign is for the lower side; Moreover

m = constant is the slope of the lift curve for infinite aspect ratio

c(y) is the chord distribution of the wing

V is the free stream velocity, and

 $\alpha(y)$  is the angle of attack distribution.

A harmonic function satisfying these boundary conditions is generally difficult to find because of the occurrence of the variable coefficient in the  $\emptyset$  term. The method of attack of the Laporte method is as follows:

<sup>\*</sup> Microfilm copy of complete manuscript of 122 pages, \$1.53. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-389.

- 1. A conformal transformation is applied to the boundary value problem. Laplace's equation remains invariant whereas the boundary conditions, eq. (2), acquires different coefficients for both the Ø term and the right hand side.
- 2. The boundary condition (2) is next reduced to one with constant coefficients by a suitable choice of the chord function c(y).

The first conformal transformation used was

$$U = \frac{b}{4} \left[ \sqrt{k} S_n \frac{2Kt}{\pi} + \left( \sqrt{k} S_n \frac{2Kt}{\pi} \right)^{-1} \right]$$
 (3)

where t = r + is, k is the modulus of the elliptic function, and K is the complete integral of the first kind. The resulting chord function is

$$c(y) = c_0 \sqrt{(1-\eta^2)(1-k^2\eta^2)}$$
 (4)

Here  $\eta = \frac{2y}{b}$ , and  $\frac{1}{k} = \frac{1}{2}(\frac{1}{\sqrt{k}} + \sqrt{k})$  and  $C_0$  is the root chord.

The hypothesis used for the solution in the t-plane is

$$\varphi$$
 (r,s) =  $\sum_{n=1}^{\infty}$  Sinh ns (A<sub>n</sub>cosnr+ B<sub>n</sub>sinnr) (5)

where the coefficients  $A_n$  and  $B_n$  are to be determined by the boundary conditions.

The second mapping used was

$$u = \frac{ib}{4} \left[ \sqrt{k} \operatorname{sn} \frac{2Kit}{\pi} - (\sqrt{k} \operatorname{sn} \frac{2Kit}{\pi})^{-1} \right]$$
 (6)

where i is  $\sqrt{-1}$ .

The corresponding chord function is

$$c(y) = c_0 \sqrt{(1-\eta^2)(1+k^{12}\eta^2)}$$

$$k^1 = \frac{1}{2} \left( \frac{1}{\sqrt{k}} - \sqrt{k} \right)$$
(7)

where

The hypothesis used to solve the boundary value problem in this case was

 $\varphi$  (r,s) =  $\sum_{n=0}^{\infty}$  Cosh nr (Ancosns + B<sub>n</sub> sin ns) (8)

The elliptic and parabolic planforms appear to be special cases of the above results.

The angle of attack distributions treated are as follows:

1. 
$$\alpha(y) = \alpha_0 + \beta(\frac{4}{b/4}) + \gamma(\frac{y}{b/4})^4$$

2. 
$$q(y) = \delta \frac{y}{b/4}$$

Here  $\alpha_0, \beta, \gamma$  and  $\delta$  are constants.

The overall force and moment coefficients are then obtained from the above results by an integration.

#### REFERENCES

- 1. Laporte, O. "Rigorous Solutions for the Spanwise Lift Distribution of a Certain Class of Air Foils," Journal of Applied Mathematics, Fall Issue, 1944.
- 2. Trefftz, E. "Prandtlsche Trag flächen-und Propellertheorie" ZAMM, Vol. I, 1922, pp 206 218.

#### DIAGNOSIS OF PLANT NUTRIENT DEFICIENCIES BY MEANS OF SOIL TESTS: PLANT TISSUE TESTS, AND FOLIAR ANALYSIS

(Publication No. 1229)\*

J. Quentin Lynd, Ph. D. Michigan State College, 1948

The principal objective of this investigation was to make a comparative study of soil tests, plant tissue tests, and foliar analysis for indicating the nutrient status of corn plants.

Greenhouse and field experiments were undertaken to compare tissue testing and foliar analysis as to precision in detecting soil fertilizer treatment. Especial effort was made to determine which portion of the corn plant is a dependable indicator of its nutrient status and to determine the time of sampling most suitable for these tests.

Tissue tests of the third functioning basal leaf of corn plants were found to be a reliable method for detecting soil fertilizer treatments for the elements nitrogen, phosphorus, and potassium on soil types varying widely in physical and chemical characteristics.

Results of foliar analysis studies in field experiments indicated that the nutrient composition of the third functioning basal leaf of corn plants decreased with an increase in maturity.

A method for determining manganese in fresh tissue was found to give a reliable indication of the total manganese present in the foliage of white bean plants grown in the greenhouse.

In the course of this investigation a method was devised for making permanent plastic standards for use in rapid soil and tissue testing procedures.

Soil testing procedures were applied to soil samples taken from rotation-fertilizer field experiments at their initiation and after seven years of continuous experimental treatment. Results of these soil analyses did not reflect sufficient deviation between treatments to account for the large differences in yields. Results of microbiological testing procedures did not show conclusive evidence as to the nitrogen supplying status of the experimental plots. Experiments with soil from these rotation-fertilizer field experimental plots indicated that the lowest yielding plots in the field were

<sup>\*</sup> Microfilm copy of complete manuscript of 94 pages, \$1.18. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-29.

temporarily capable of relatively higher production if given treatment suitable for nitrate production in the greenhouse.

Tissue Tests throughout two seasons on these rotation-fertilizer field experiments indicated that nitrogen is the limiting factor in plant growth and that a definite change took place in the nitrogen status of plants with the initiation of the flowering period. Foliar analysis for total nitrogen in leaf samples taken during the flowering period indicated positive correlations with corn yields.

It is proposed in this investigation that green tissue tests be utilized for determining the period of sampling for foliar analysis, for indicating possible limiting factors in plant growth, and as an aid in the interpretation of foliar analysis.

### LIME CONTENT OF SOIL IN RELATION TO CROP RESPONSE TO MAGNESIUM

(Publication No. 1267)\*

Bishwanath Sahu, Ph. D. Michigan State College, 1949

This investigation was undertaken to study by means of pot culture the lime content of soil in relation to crop response to magnesium.

Four soils were used for the study including two, the Wisner and Hillsdale subsoil, which were alkaline in reaction and contained free carbonates, and two, the Plainfield and Fox sand, which were acid and low in degree of base saturation. Quartz sand cultures were also used for comparative purposes.

Calcium and magnesium applications were made on the basis of percent saturation of the exchange complex. The treatments were designed to evaluate the effect of increasing amounts of magnesium when calcium was held constant and the changes caused by variations in the proportions of the two cations at constant level of base saturation.

Tomato, tobacco and corn were grown as test crops. Growth, yield and composition of the crops were determined.

In the alkaline Wisner soil, containing a fair amount of organic matter and mineral colloids, high applications of magnesium were found to destroy tilth of the soil. Morphological characteristics of

<sup>\*</sup> Microfilm copy of complete manuscript of 129 pages, \$1.62 Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-67

a solonetz soil were noticed. The growth of young seedlings was poor due to the high water tension.

In sandy Hillsdale subsoil very little response to magnesium was noticed. Due to the high pH there was considerable fixation of magnesium as insoluble magnesium silicate. This was indicated by the low recovery of exchangeable magnesium after harvesting the crop.

In the acid soils, Plainfield and Fox, the response to magnesium was best when the base saturation was high and the soil reaction was about neutral.

In all soils, when the concentration of magnesium was higher than calcium, magnesium sickness of the plant was conspicuous. There was sufficient vegetative growth to maintain a good healthy plant but the growth was insufficient to induce fruiting in tomato.

With increasing concentrations of magnesium, at a constant calcium concentration, the calcium content of the plants decreased. The magnesium content increased with a linear relationship and potassium content was increased up to the 75 percent saturation with respect to magnesium, but beyond this the K content decreased. Growth and yield were directly proportional to Ca and inversely proportional to magnesium at high magnesium levels in the soil.

Although there was great variation in the uptake of individual cations, the sum total of the cations was constant with the different treatments. This indicates that the cations perform some common function in the plant.

No direct correlation between the magnesium and phosphorus uptake was observed with any of the crops studied. The idea that Mg ions act as a carrier of  $PO_A$  ions is questionable.

Factors influencing the differential uptake of calcium and magnesium have been discussed.

The results of this investigation emphasize that it is not the Ca:Mg ratio but the concentration and degree of saturation of the exchange complex with calcium that determine the response of crops to the application of magnesium.

## THE EFFECT ON VARIABILITY IN THE DOUBLE CROSS CORN HYBRID OF PARENTAL INBREDS DIFFERING IN MATURITY AND OTHER PLANT CHARACTERISTICS

(Publication No. 1269)\*

James Warren Thayer, Jr., Ph. D. Michigan State College, 1949

Eight inbreds, differing in maturity and other plant characters, were crossed in all possible single and double cross combinations. Individual plant measurements were obtained for ear moisture, ear dry weight, ear length, ear diameter, ear number of rows, ear height and plant height of the inbreds, the 28 single crosses and 65 double crosses.

For each character studied, the inbreds were divided into contrasting groups to make comparisons between progenies resulting from the crossing of similar and contrasting inbreds. Analyses of variance were calculated from the individual plant data. Crosses were grouped, on the basis of cross type as determined from parental inbreds, and group comparisons were made.

Significant differences were found to exist between the means of the highest and lowest inbreds for each character. Significant differences in inbred variability were attributed to inbred sensitivity to environmental conditions.

In the single crosses, tall x tall inbreds gave the tallest hybrids; short x short, the shortest; and tall x short, hybrids with intermediate mean heights. For all other characters, there was tendency for the crossing of the high x high value inbreds to produce high value hybrids; low x low, low value hybrids; and high x low, hybrids with intermediate mean values. However, hybrids with similar mean values were obtained from all three types of crosses.

Significant differences in variability were obtained between single crosses for all characters. Except for ear weight, significant differences were obtained between some group mean variances for the three types of single crosses.

In the double crosses, many of the group mean differences, although statistically significant, were so small as to be of doubtful value from an agronomic viewpoint. The tendency for the hybrids to reflect or be similar to their parental inbreds was present in the double crosses to a lesser degree than in the single crosses.

<sup>\*</sup> Microfilm copy of complete manuscript of 88 pages, \$1.10 Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-69.

There were significant differences between many of the group mean variances for all characters in the double crosses. However, the variances for the individual crosses were so variable and there was so little consistency between the group mean variances for the different characters that it was impossible to say that one type of cross consistently produced greater variability in its progenies than any other.

Predicted mean and variance values were obtained for all characters in the double crosses by averaging the four non-parental single cross values. Significant correlation coefficients were obtained between the actual and predicted mean values for all characters and between the actual and predicted variances for some characters. With the mean values, the r-values were sufficiently large for several characters to indicate the worthwhileness of this method for prediction purposes but in no instance was the r-value between the actual variance and the predicted variance sufficiently large to indicate that variance in the double cross may be satisfactorily predicted.

The results of this study indicate that inherent inbred characteristics are more important in determining variability in the double cross than is the method of combining the inbreds.

# THE EFFECT OF VARIED LEVELS OF NITROGEN, PHOSPHORUS, POTASSIUM, AND BORON IN SOIL ON THE YIELD AND CHEMICAL COMPOSITION OF GREENHOUSE TOMATOES

(Publication No. 1270)\*

Andrew J. Watson, Ph. D. Michigan State College, 1949

Tomatoes were grown in the greenhouse in glazed earthenware jars at different nutrient levels. Nitrogen, phosphorus, and potassium levels were based on parts per million in the soil extract according to the Spurway soil testing procedure.

Two factorial experiments involving nitrogen, phosphorus, and potassium levels were conducted. Fruit yield, dry weight of plants, and the percentage of nitrogen, phosphorus, and potassium in the leaves were obtained for each treatment. Highest fruit yields resulted where the nitrogen level was maintained between 25 and 50

<sup>\*</sup> Microfilm copy of complete manuscript of 105 pages, \$1.32. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-70.

ppm, phosphorus between 5 and 10 ppm, and potassium between 15 and 30 ppm. Nitrogen levels above 50 ppm in Oshtemo loamy sand resulted in a marked decrease in both fruit yield and dry weight. Phosphorus and potassium levels as high as 25 and 60 ppm, respectively, on Oshtemo loamy sand and as high as 40 and 100 ppm, respectively, on Brookston silt loam were not toxic to the plants where the nitrogen supply was adequate.

Deficiency symptoms of nitrogen, phosphorus, and potassium were observed.

Several interrelationships of the three major elements were noted. In the presence of low available potassium, symptoms of potassium starvation appeared earlier and with greater severity where either or both nitrogen and phosphorus levels were increased. With a low supply of available phosphorus, symptoms of phosphorus starvation were progressively more severe with increased nitrogen levels. High phosphorus levels tended to counteract the harmful effects of excessive nitrogen. The percentage of nitrogen, phosphorus, and potassium in the dry leaf samples increased with each addition of their respective salts. Low nitrogen levels favored the accumulation of potassium in the leaves, but had no effect on the phosphorus content. Phosphorus levels had no effect on the concentrations of nitrogen and potassium in the leaves. Low potassium levels favored accumulation of phosphorus in the leaves, but had no effect on the nitrogen content.

Differential varietal response to potassium fertilizer was studied. Improved Bay State tomatoes required a higher concentration of potassium in the leaves than did the Spartan Hybrid plants in order to prevent the occurrence of leaf yellowing due to potassium starvation. High potassium levels caused a reduction in the percentage of calcium and magnesium in the leaves.

Tomatoes were grown on four soil types with boron treatments varying from 0 to 200 pounds per acre of Na<sub>2</sub>B<sub>4</sub>0<sub>7</sub>. Chemical analyses were made of soil and tissue samples. The concentration of boron in the plant tissue was directly related to the amount in the soil. The plants developed normally when the concentration of water soluble boron in the soils ranged from 0.50 to 2.75 ppm. When the concentration varied greatly from this range deficiency or toxicity symptoms were noted. Applications equivalent to 50 pounds per acre or more of Na<sub>2</sub>B<sub>4</sub>0<sub>7</sub> resulted in the occurrence of boron toxicity symptoms on the plants.

# CHARACTERISTICS OF THE SUBSTRATES AND MEDIA ESSENTIAL FOR METABOLISM AND MOTILITY OF RAM, BOAR, AND STALLION SPERMATOZOA

(Publication No. 1284)\*

Burton Harold Moore, Ph. D. University of Missouri, 1946

The application of artificial insemination to livestock breeding is directly dependent upon the possibility of storing spermatozoa for prolonged periods with maintenance of fertilizing potentialities. Knowledge of the metabolic processes by which the spermatozoa maintain viability, motility and fertilizing capacity is necessary to indicate the components of the storage medium needed to supply the metabolic substrates and to minimize toxic effects of metabolic end-products during storage of spermatozoa. The studies reported below were made to supply information which can be applied to the preparation of diluting media and to maintenance of nearly ideal conditions for storage of the spermatozoa of livestock for breeding purposes.

The information available in published form pertaining to metabolism of the spermatozoa of several mammalian species is reviewed. Glycolysis is indicated as being a preferred metabolic process for human, bull and ram spermatozoa. In the absence of glycolyzable carbohydrates, bull and ram, but not human, spermatozoa have been found to be capable of oxidative metabolism involving phospholipids.

The investigations reported in this dissertation were made with ram, boar and stallion spermatozoa, both in semen and in synthetic isotonic media. Chemical methods for reducing sugar, lactic acid, and various phosphorus and nitrogen fractions were adapted for analysis of samples of spermatozoan suspensions withdrawn at timed intervals during incubation at 37.5° C.

The results of these investigations were interpreted as leading to the following conclusions:

Both ram and boar spermatozoa were found to exhibit glycolytic activity. Some evidence was also obtained indicating a similarity between boar and stallion spermatozoa. The reducing substances

<sup>\*</sup> Microfilm copy of complete manuscript of 150 pages, \$1.88. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-84.

in ram semen are converted to lactic acid but no conversion of the reducing substances in boar and stallion semen could be demonstrated.

Glucose, fructose and mannose are glycolytically converted to lactic acid by ram and boar spermatozoa. Lactic acid appears to be the sole product of sugar metabolism by these spermatozoa. Neither ram nor boar spermatozoa were able to utilize galactose or maltose.

The results of the investigations with the above sugars, other sugars, and related substances indicate the absence of enzymes in ram and probably in boar spermatozoa necessary to: (a) hydrolyse the  $\alpha$ - and  $\beta$ - glucosidic linkages of di- and polysaccharides, (b) to utilize sugars modified by oxidation of the aldo group or by substitution of an amino group for a hydroxyl group, and (c) to utilize sugars modified by variations in the steric configuration of glucose other than those represented by fructose and mannose.

The oxidative metabolism of boar and probably stallion spermatozoa is not associated with appreciable changes in lipid phosphorus. In the absence of glycolysable sugar; ram, boar, and stallion spermatozoa are capable of motility only in the presence of oxygen. However, since aerobic conditions are difficult to maintain during storage and transportation of semen, it is suggested that adequate quantities of an isotonic medium containing glucose and buffers, in addition to other substances, be used in dilution of semen.

No appreciable differences were obtained during glycolysis by ram spermatozoa in the presence of sodium phosphates, sodium citrate, or sodium bicarbonate.

Control of contaminating microorganisms in semen may be possible by use of antibiotic substances, since sulphathiazole does not alter glycolysis by ram spermatozoa.

The pH shift in stallion and probably in boar semen is attributable to losses of a volatile acidic substance which may be carbon dioxide.

### AN INVESTIGATION OF GALACTIC STRUCTURE IN A REGION OF CYGNUS

(Publication No. 1183)\*

Paul Richard Annear, Ph. D. University of Michigan, 1949

This investigation is concerned with the obscuring material, stellar distribution, and the form of the luminosity function in a region of Cygnus where the surface distribution of the stars is quite irregular. The galactic longitude is forty degrees and the galactic latitude is plus one degree. Previous investigations have indicated that the bright appearance of part of the region (part of the "Cygnus Cloud") is due mainly to contrast with a dark part of the region (part of the "Rift"). The distance of the dark nebula responsible for this has been thought to be near eight hundred parsecs, and its absorbing power at least two magnitudes in photographic light. The region, near P Cygni, is also noted for the clustering of luminous peculiar stars.

This region is one of twelve galactic fields being investigated at the Warner and Swasey Observatory of the Case Institute of Technology, and the instrument used is that observatory's twenty-four inch Schmidt-type Burrell telescope. Preliminary results in an overlapping field had indicated a clustering of B-type stars at about two thousand parsecs. These apparently extended toward the region under investigation in this paper; this provided another reason for pursuing this study.

The procedure followed was to obtain blue (photographic) magnitudes and spectral types (with the objective prism) for all stars brighter than the twelfth magnitude, and also red magnitudes for those stars of spectral type O through AO. By comparing the observed colors of the early type stars with their intrinsic colors, a value of the selective absorption was obtained, which was converted to photographic absorption. Star-counts were made to magnitude 17.6 as an aid in determing the absorption features over the plate.

On the basis of the colors, the region was divided into two areas, one of which is part of the Rift. In both areas the absorption seems to become appreciable at five hundred parsecs. In the Rift area the absorption increases rapidly to about two and one-half magnitudes

<sup>\*</sup> Microfilm copy of complete manuscript of 98 pages, \$1.23. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-392.

at fifteen hundred parsecs. In the other area it increases more slowly to about two magnitudes at three thousand parsecs. Using this absorption, a density analysis was made for various spectral type groups in each area, using a numerical type of analysis. The B-type stars showed clustering tendencies at various distances, in rough agreement with the overlapping field. In the Rift area these spectral groups contained greater numbers in the clusters; this may be a result of over-correction for absorption. In the other area, the spectral groups A2-A5, FO-F5, and F8-M giants all showed rapid decreases in density going outward from the sun — a result found generally for these spectral groups.

A comparison with the standard luminosity function revealed an excess of luminous stars (absolute magnitude between minus four and plus one) in this region, and a deficiency of less luminous stars (absolute magnitude between plus one and plus four), a result in agreement with conclusions reached in two other fields included in

this series.

## THE ISOLATION OF ANTIGENS FORMED BY HISTOPLASMA CAPSULATUM AND THEIR EVALUATION BY PRECIPITATION AND HYPERSENSITIVITY REACTIONS

(Publication No. 1176)\*

Anne Louise Pates, Ph. D. University of Michigan, 1949

Histoplasmosis is a striking example of a disease of man which has come into prominence in recent years. Patients with the acute type of the infection and individuals with chronic involvements have been recognized. The latter have been found in the course of surveys designed to determine the incidence of tuberculosis in large portions of the population. The presence of calcified areas in the lungs of many of the individuals with negative tuberculin reactions has led to the detection of patients with subclinical histoplasmosis. The importance of correctly diagnosing this latter group was instrumental in the introduction of skin testing with histoplasmin. It was soon apparent that this substance, usually the filtrate of a broth culture of Histoplasma capsulatum, gave non-specific reactions. The neccesity of having a more refined procedure was perfectly clear and the present investigation has been directed at the isolation of a specific metabolic product from histoplasmin for us in precipitation reactions and hypersensitivity tests.

A routine method for the production of histoplasmin was first established. This consisted of inoculating a synthetic medium fortified with yeast extract with tiny pellets of organisms supported on glass wool to insure surface growth. Following an incubation period of approximately 60 days at room temperature (22° - 24° C) an excellent surface growth occurred and the cells were removed by passage through a Seitz filter. The filtrate, free of microbic forms and designated histoplasmin, was treated in a variety of ways for the recovery of the metabolic products. The method finally adopted consisted of precipitation with 95 percent ethanol. The addition of 1 volume of the alcohol to histoplasmin adjusted to pH 4.2 resulted in the formation of a precipitate. Solutions of this precipitate could be separated into 2 components. Number 1, a protein-like substance, was precipitated when the solution was readjusted to pH 4.2. Number 2, a polysaccharide-like material, was thrown down by the

<sup>\*</sup> Microfilm copy of complete manuscript of 121 pages, \$1.52. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-385.

addition of a volume of ethanol after the removal of fraction 1. Two additional fractions, number 3 and 4, were obtained at pH 11.2 from histoplasmin freed of fractions 1 and 2. The chemical nature of fraction 3 was undetermined; fraction 4 was polysaccharide-like in nature.

Two methods for the detection of the presence of antigen in histoplasmin or solutions of the fractions isolated from it were investigated. The first of these consisted of intradermal injections of the test material into rabbits or guinea pigs inoculated with a single strain of H. capsulatum. It was soon found, however, that normal animals during the course of routine testing with histoplasmin may be sensitized to this reagent and in addition antibodies may appear in the blood stream. Such reactions were considered undesirable, and therefore the precipitation reaction, which had been shown to be satisfactory for the detection of precipitinogens in histoplasmin, was considered to be superior to skin tests for the purpose at hand and was used extensively throughout this work.

All 4 fractions isolated from histoplasmin gave positive reactions with antisera obtained from rabbits inoculated with H. capsulatum. Three of them also elicited hypersensitivity reactions of the delayed type when injected intradermally into the same animals.

Specificity of the fractions was determined by precipitation and hypersensitivity reactions performed on rabbits inoculated with a single strain of Blastomyces dermatitidis. Animals so inoculated were chosen because in the work done in this laboratory they had been shown to produce antibodies not only to blastomycin, but also to histoplasmin and, as has been observed by others, were sensitized to the 2 antigens.

In the precipitation reaction, fraction 1 was non-specific as it reacted with sera obtained from the rabbits inoculated with B. dermatitidis. Fractions 2 and 3 were relatively specific as reactions occurred only infrequently with these sera. When used in hypersensitivity tests, only fraction 4 failed to cause reactions when injected into rabbits inoculated with B. dermatitidis.

In conclusion, it is believed that fraction 4 when used either in precipitation or hypersensitivity reactions offers unusual promise as a specific aid in the detection of histoplasmosis.

### AN INVESTIGATION OF NEW ROUTES FOR THE SYNTHESIS OF SEX HORMONES AND THEIR ANALOGS

(Publication No. 1173)\*

Reynold Emanuel Holmen, Ph.D. University of Michigan, 1949

This dissertation comprises a study of the possibility of using the so-called  $\beta$ -oxoester route for the synthesis of equilenin and analogs, and of running the Arndt-Eistert synthesis directly on the dehydrated acids from the Reformatsky reaction with appropriately substituted 1,2,3,4-tetrahydrophenanthrenes to provide another route to the steroids.

A known synthesis of diethyl  $\beta$ -oxoadipate was improved to give a 50% increase in yield. This ester was condensed with  $\beta$ -1-naphthylethyl bromide to give the diethyl ester of 4-oxo-5-carboxy-7- $\alpha$ -naphthylheptanoic acid. Cyclodehydration with 85% sulfuric acid gave  $\beta$ -(2-carbethoxy-3,4-dihydro-1-phenanthrene)-propionic acid, which was hydrolyzed to the known dicarboxylic acid. This acid was then cyclized to the known 3'-oxo-3,4-dihydro-1,2-cyclopentenophenanthrene and also reduced with sodium amalgam to mixed saturated acids. The new higher melting saturated acid was cyclized to what may be the true nordesoxyequilenin.

 $\beta$ -6-Methoxynaphthylethyl bromide was condensed with dimethyl  $\beta$ -oxoadipate and with diethyl  $\beta$ -oxo-adipate. Cyclodehydration of the products with sulfuric acid gave after hydrolysis the new  $\beta$ -(2-carboxy-7-methoxy-3,4-dihydro-1-phenanthrene)-propionic acid, the structure of which was shown by cyclization to the known 3'-oxo-7-methoxy-3,4-dihydro-1,2-cyclopentenophenanthrene. The dicarboxylic acid was also reduced with sodium amalgam to the saturated acids. The new higher melting saturated acid was cyclized to what may be the true norequilenin methyl ether.

The diethyl ester of  $\beta$ -oxoadipic acid was methylated to the  $\alpha$ -methyl analog, identified by conversion to the semicarbazone of homolevulinic acid, to derivatives of 5-oxo-2-pyrroline-2-propionic acid, and by the subsequent course of the synthesis.

The condensation of the potassio derivative of diethyl a-methyl- $\beta$ -oxoadipate with  $\beta$ -6-methoxynaphthylethyl iodide gave the diethyl ester of 4-oxo-5-carboxy-5-methyl-7-(6-methoxy-1-

<sup>\*</sup> Microfilm copy of complete manuscript of 127 pages, \$1.59. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-382.

naphthyl)-heptanoic acid which was cyclized with sulfuric acid to a complex mixture from which two lactones of  $\beta$ -(1-hydroxy-2-carbethoxy-2-methyl-7-methoxy-1,2,3,4-tetrahydro-1-phenanthrene)propionic acid (m.p. 143.5-145° and 160.5-162°, respectively) were isolated. A Dieckmann Cyclization gave a compound which melted with decomposition to give the methyl ether of 14,15-dehydroequilenin, identical with an authentic sample. Alkaline hydrolysis of the crude cyclodehydration product or of isolated lactone unexpectedly resulted in cleavage of the 2-carboxyl group and left  $\beta$ -(2-methyl-7-methoxy-3,4-dihydro-1-phenanthrene)propionic acid, identical with that prepared by three independent routes. One synthesis was from 1-oxo-2-methyl-7-methoxy-1,2,3, 4-tetrahydrophenanthrene via a Reformatsky reaction followed by an Arndt-Eistert reaction on the dehydrated Reformatsky acid. Another synthesis followed Haberland's reaction of the same ketone with methyl  $\beta$ -bromopropionate. The third extended this synthesis to 1-oxo-2-carbomethoxy-2-methyl-7-methoxy-1,2,3,4tetrahydrophenanthrene.

The dehydrated Reformatsky product from 1-oxo-1,2,-3,4-tetrahydrophenanthrene led to two unsaturated acids (m.p. 155-156° dec., and 218-219° dec.; only the first reported previously). An Arndt-Eistert reaction gave  $\beta$ -(3,4-dihydro-1-phenanthrene)-propionic acid or bond isomer thereof, which was converted to the also known 3'-oxo-3,4-dihydro-1,2-cyclopentenophenanthrene.

The dehydrated Reformatsky product from 1-oxo-2-methyl-1, 2,3,4-tetrahydrophenanthrene led to two new unsaturated acids (m.p.  $192-194^{\circ}$  and  $239-240^{\circ}$  dec.). The Arndt-Eistert reaction on the higher melting form gave a corresponding propionic acid (m.p.  $131-132^{\circ}$ ) — proved by dehydrogenation to the  $\beta$ -(2-methyl-1-phenanthrene)-propionic acid (m.p.  $183-184.5^{\circ}$ ), identical with a sample synthesized by Haberland's  $\beta$ -bromopropionate route.

A Reformatsky reaction on 1-oxo-2-methyl-7-methoxy-1,2,3, 4-tetrahydrophenanthrene led to an unsaturated acid, m.p. 205-  $206^{\circ}$  dec. The Arndt-Eistert reaction then gave  $\beta$ -(2-methyl-7-methoxy-3,4-dihydro-1-phenanthrene)-propionic acid, which was cyclized in poor yield to a ketone, the melting point of which was undepressed on admixture with 14,15-dehydroequilenin methyl ether. This was the first known example of such cyclization to a five membered ring involving a methyl substituted carbon.

By virtue of the known means for conversion of 14,15-dehydroequilenin methyl ether to equilenin, two additional syntheses for this hormone have thus been developed.

#### BODY MAGNESIUM AND TEMPERATURE

(Publication No. 1231)\*

Wesley Stanley Platner, Ph.D. University of Missouri, 1948

The determination of Mg in whole blood, serum and red cells is given for 22 different species of animals. Included are 13 species of freshwater fish, 1 frog (Rana pipiens), 2 turtles (Pseudmeys elegans, and Crysemes picta) 1 bird (common pigeon) and 5 mammals (hamster, guinea pig, rabbit, dog and cat).

The serum Mg of fishes did not appear to be correlated with the Mg content of the waters in which the freshwater fish were living. However aquatic animals in general have higher serum Mg than terrestrial forms. The data obtained suggest that the more active fishes have lower serum Mg than the more sluggish fishes.

The Mg content of the nucleated red blood cells of fishes, frogs, turtles and pigeons was much greater than the Mg content of the non-nucleated red blood cells of the mammals.

Fishes exposed to freezing temperatures showed a marked rise in serum Mg amounting to 159 to 627 per cent above normal in spite of an accompanying marked hemodilution. This increase in Mg in the serum of fishes subjected to cold apparently came very largely from the nucleated red blood corpuscles.

A marked rise in serum Mg occurred in turtles exposed to cold. In these animals no hemodilution or hemoconcentration was observed with reduction of body temperature. The increase of Mg in the serum of the cold treated turtles seemed to be drawn largely from the skin and skeletal muscle.

Pigeons in which the thalamic portion of the brain had been destroyed previously when subjected to cold showed some hemoconcentration. In these birds there was a marked rise in the serum Mg and a fall in the Mg content of the red blood cells.

The per cent of dialyzable Mg in the serum was not changed appreciably when the serum Mg was increased by exposure to cold.

The possible significance of the increased serum Mg attendant on the reduction of body temperature is discussed.

<sup>\*</sup> Microfilm copy of complete manuscript of 249 pages, \$3.12. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-31.

THE USE OF RADIOACTIVE PHOSPHORUS IN TOOTH METABOLISM STUDIES OF CARIES RESISTANT AND CARIES SUSCEPTIBLE STRAINS OF ALBINO RATS

(Publication No. 1230)\*

Ray Louis Shirley, Ph.D. Michigan State College, 1949

Hoppert et al. demonstrated in 1931-32 that dental caries could be developed in rats by feeding diets containing coarsely ground corn or rice. Subsequently, Hunt, Hoppert, et al. have made a genetic study in which two distinct strains of Albino rats have been developed that vary markedly in their susceptibility to dental caries. The susceptible and resistant strains have been inbred through eighteen and fourteen generations, respectively.

In this investigation a comparison of the whole teeth of the resistant and susceptible strains and stock rats has been made with regard to (1) weight, (2) ash content, (3) phosphorus content expressed as per cent of (a) the dry weight of the teeth, and (b) of the ash, (4) rates of deposition and removal of radioactive phosphorus in the teeth after intraperitioneal injection of the isotope, (5) occurrence of labelled phosphorus in the teeth of offspring whose mothers were injected intraperitoneally with the isotope during pregnancy, and (6) adsorption of radioactive phosphorus in vitro by the teeth from aqueous solution. The rats were maintained on a nutritionally adequate ration, but one that was cariogenic due to its content of ground rice.

Approximately 275 rats were used in this investigation. The teeth were removed after sacrifice, dried at 103° C. in a hot air oven, weighed, and the ash determined by heating in a muffle furnace at 600° C. The ash was dissolved in approximately 2.5 N hydrochloric acid, and aliquots were taken for the determination of total phosphorus by the volumetric phosphomolybdate method, and for the determination of the radioactive phosphorus in the case of the tracer studies. The phosphorus-32 was determined with an immersion-type Geiger-Mueller tube used in conjunction with a Tracerlab Inc. Autoscaler counter. The radioactive phosphorus was obtained from Oak Ridge after allocation by the Atomic Energy Commission.

<sup>\*</sup> Microfilm copy of complete manuscript of 63 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-30.

The data obtained in this investigation of the teeth of the two strains of Albino rats that are markedly different in their susceptibility to dental caries indicate that they varied in the following respects:

- 1. The teeth of the resistant strain are slightly lighter in weight after 30 days of age.
- 2. The molars of the resistant strain have approximately 2 per cent more ash in the age range of 20 to 60 days.
- 3. The molars of the resistant strain have approximately 0.5 per cent more phosphorus on the dry weight basis, in the age range of 20 to 60 days.

The two strains were found to be essentially the same in the following respects:

- 1. Per cent ash in the incisors.
- 2. Per cent phosphorus in the incisors on the dry weight basis, and per cent phosphorus in the ash of the molars and incisors.
- 3. Rate of deposition and removal of radioactive phosphorus in the teeth when the isotope was administered intraperitoneally at 20 to 35 days of age.
- 4. Occurrence of radioactive phosphorus in the teeth of offspring of females that were injected intraperitoneally with the isotope during pregnancy.
- 5. In vitro adsorption of the isotope by the teeth from aqueous solution.

# GROWTH INTERACTIONS BETWEEN KENTUCKY BLUEGRASS (POA PRATENSIS) AND KOREAN LESPEDEZA (LESPEDEZA STIPULACEA) UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

(Publication No. 1271)\*

Joe Daniel Baldridge, Ph.D. University of Missouri, 1946

Korean lespedeza, an annual, is a useful legume to grow with perennial grasses in pastures throughout much of a broad belt extending from the western borders of Kansas and Oklahoma to the Atlantic coast. Cultural practices and grazing management for the establishment and maintenance of lespedeza in highly competitive swards such as bluegrass must take into account the varying interaction between the two species during different periods of the growing season. Under natural conditions, interactions between species are influenced by environmental factors which vary together. In order to determine the separate effects of some of these factors, pure and mixed stands of bluegrass and lespedeza were grown in pots under controlled conditions. The factors varied included (a) seasonal light conditions, (b) temperature, (c) nitrogen level, (d) defoliation treatment, (e) type of culture medium, and (f) inoculation of lespedeza.

Under conditions favorable for a vigorous growth of both species, the interaction was characterized by mutual harm, lespedza being retarded to a greater extent than bluegrass. Only two cases of benefit occurred: (1) the presence of bluegrass enabled the lespedeza to survive the short days and low light intensities of winter, and, (2) under conditions of summer light and minimized competition for water, bluegrass was stimulated by lespedeza.

The reciprocal effects of bluegrass and lespedeza were greatly influenced by seasonal light conditions. Only those light conditions which prevailed during the summer growing season were entirely satisfactory for studying the normal interactions between these species. The use of supplementary light during the winter did not restore the interaction to normal.

Bluegrass produced much larger yields of herbage, roots, and rhizomes in the spring than in the fall. The progressively

<sup>\*</sup> Microfilm copy of complete manuscript of 209 pages, \$2.62. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-71.

increasing and progressively decreasing photoperiod in the spring and fall, respectively, appeared to condition the difference in response, since the average day length for the two growth periods was the same.

The series grown under summer light gave the following results:

(1) In lightly or heavily defoliated cultures, lespedeza was increasingly retarded by bluegrass with each 10° decline in temperature from 80° to 60° F. In unclipped cultures, the legume was almost completely suppressed at all three temperatures.

(2) Bluegrass was significantly retarded by lespedeza only at 80° F., the temperature at which the legume made its most vigorous growth. Defoliation of mixed cultures increased the extent to which the grass was injured by the

legume.

(3) Increasing the available nitrogen supply in the medium increased the competitive ability of the grass at the expense of the legume, especially at a low temperature of 60° F.

(4) Progressively heavier defoliation at 60° F. benefited lespedeza in its competition with bluegrass. At 80° F., light defoliation aided the legume and retarded the grass, but heavy defoliation retarded both species.

but heavy defoliation retarded both species.

(5) The use of soil as a culture medium for studying the interactions between bluegrass and lespedeza appeared preferable to the use of a sand or sand-clay medium watered with nutrient solution.

(6) Prompt, abundant nodulation of lespedeza seedlings was a decisive factor in securing successful establishment of the

legume in the grass.

(7) Mixed cultures of bluegrass and lespedeza tended to yield more herbage but less roots than pure cultures of bluegrass. The concentration and total yield of nitrogen in the herbage of mixed cultures exceeded that in the herbage of pure cultures of grass.

Of a total of eight series covering a variety of environmental conditions, only one gave evidence of a transfer of nitrogen from actively growing lespedeza to bluegrass. It appears that under ordinary conditions the movement of important amounts of nitrogen from the legume to the soil must await the death and decay of the plant.

The major portion of the nitrogen in Korean lespedeza is contained in the above-ground parts of the plant. The benefits derived by bluegrass from nitrogen fixed by the legume will

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depend, therefore, upon the return to the soil of a large portion of the nitrogen in the legume tops.

Studies made under controlled conditions have contributed to a fundamental understanding of the interactions between bluegrass and lespedeza in mixed stands. Certain applications of the results to pasture management practice are indicated in the discussion.

The literature review contained in this paper is divided into two parts: (1) General review of plant interactions; (2) interactions in mixed stands of legumes and non-legumes. Reference is made to 202 literature citations.

## A STUDY OF SEED FERTILITY IN CROSSES BETWEEN OENOTHERA FRANCISCANA BARTLETT AND ITS TETRAPLOID

(Publication No. 1238)\*

Pearl Mei-Chu Liu Chen, Ph.D. University of Michigan, 1937

Oenothera franciscana is about 90 per cent seed fertile and its tetraploid derivative about 60 per cent seed fertile, but reciprocal crosses between the two are highly seed sterile. The cross franciscana x tetraploid tests gave an average seed fertility of 13.5 per cent and the tetraploid x franciscana 11.9 per cent. The thesis covers research on meiosis in the megasporocytes of the diploid franciscana, of its tetraploid and of the triploids. It also includes studies on the rate of growth of the pollen tube, fertilization, endosperm growth, and embryonic development.

The chromosome configurations at diakinesis in the megasporocytes show for <u>franciscana</u> 7 pairs, and for the tetraploid the 28 chromosomes distributed as a mixture of quadrivalents in chains or in circles, bivalents as rings or in an end to end arrangement, and frequently as univalents. The triploid presents its 21 chromosomes as univalents, bivalents, and trivalents in chains.

Segregation of chromosomes in <u>franciscana</u> gives uniform gametes with 7 chromosomes. That of the tetraploid presents frequent irregularities due mainly to the lagging of chromosomes

often in the first division and occasionally in the second division of meiosis. Much higher degrees of irregularity were found in the

<sup>\*</sup> Microfilm copy of complete manuscript of 95 pages, \$1.19. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-38.

triploids due to varied arrangements of the trivalents at metaphase of the first division, with a chance distribution of univalents, and to lagging and non-disjunction. Segregation in the triploids gives gametes with a range from 7 to 14 chromosomes. Therefore, the progeny from the selfed triploids presents a variety of types including frequent franciscana plants (14 chromosomes) and franciscana dwarfs, rarely triploids (21 chromosomes), occasionally tetraploids (28 chromosomes), and various hyperploids (15, 16, 22 chromosomes).

The female gametophytes usually develop from the megaspore nearest to the micropyle. They are tetranucleate. Occasionally twin gametophytes are present in diploids, triploids, and tetraploids. They usually lie one above the other and are probably derived from different megaspores. As a rule the upper one of the megaspores in a tetrad matures more rapidly and is more likely to develop the gametophyte.

The pollen tube growth of <u>franciscana</u> is rapid, reaching the embryo sacs about 48 hours after pollination. The tubes of the tetraploid may take 72 hours to reach the sacs. Those of <u>franciscana</u> grow very slowly in the style of the tetraploid requiring in some cases 96 hours to penetrate the sacs, and tubes of the tetraploid grow even more slowly in the styles of franciscana.

The factors responsible for the slowness of the growth of the pollen tube in the two crosses seem to be associated with abnormal quantitative chromosome relations between the tissue of the style and the pollen tube.

When the two sperm nuclei are discharged one of them fuses with the egg nucleus and the other with the polar nucleus. The primary endosperm nucleus may have produced 16 endosperm nuclei before the zygote prepares for the first division. Fertilization in franciscana takes place in all of the sacs that have been entered by the pollen tubes, and in the tetraploid fertilization it is usually successful. In the two crosses 25 to 30 per cent of the sacs are never entered by the tubes, and in many cases fertilization does not follow after their entrance.

Endosperm growth and the first division of the zygotes are regular and normal in <u>franciscana</u>, but in the tetraploid this growth is slower and with examples of arrested development. The two reciprocal crosses present very large numbers of zygotes and much endosperm in stages of disintegration.

Embryo development in <u>franciscana</u> is very uniform and irregularities were not noted until late in the development of the seeds, about 5 per cent of which were found to contain abnormal embryos. In the tetraploid-embryo development was found to be arrested at various times from the earliest stages to the mature

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seeds with the result that 33.2 per cent of the seed-like structures had abortive embryos or were empty. In the two crosses many more embryos were found abortive at various stages of development, an early breakdown resulting in empty seeds. In the cross franciscana x tetraploid about 87 per cent, and in the reciprocal cross about 88 per cent of the seeds were found to contain abortive embryos or to be empty.

The high degree of seed sterility presented by these two crosses is believed to be due (1) partly to the irregularities of chromosome segregation in the tetraploid, but (2) chiefly to the aging of the gametes resulting from a slow growth of the pollen tubes.

## CHARCOAL ROT OF SOYBEAN CAUSED BY MACROPHOMINA PHASEOLI (MAUBL.) ASHBY

(Publication No. 1223)\*

James Monroe Crall, Ph.D. University of Missouri, 1948

Studies of a number of isolates of Macrophomina phaseoli (Maubl.) Ashby showed that the fungus was composed typically of multinucleate cells, between which anastomosing hyphae were common. Sclerotia were composed of anastomosed masses of hyphae and were generally less than 120 µ in diameter. Slow-growing "mutant" cultures of the fungus occasionally appeared in culture after mass transfers or from single spore isolations. Pycnidia were produced on the stems of diseased soybean plants but not in culture. They were typically globose to subglobose, with or without short necks, but with distinct ostiolar pores. It was suggested that the original descriptions of the genus and the species be emended to include isolates producing distinctly ostiolate pycnidia. The range of average pycnidial diameters of ten isolates was 151-192 x 134-165 μ, while the overall range of pycnidial diameters was 105-262 x 105-225 μ. Spores were multinucleate and frequently septate on germination. The range of average spore size of fifteen isolates was 19.0-23.9 x 8.4-10.2  $\mu$ , while the overall range of spore sizes was 12.3-35.4 x 6.9-12.9  $\mu$ .

Some isolates of Macrophomina phaseoli produced a red pigment on oatmeal agar, for which character they were genetically

<sup>\*</sup> Microfilm copy of complete manuscript of 154 pages, \$1.93. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-23.

stable. Chromogenic isolates produced pycnidia and spores more abundantly than non-chromogenic isolates. Spores of non-chromogenic isolates were generally slightly larger than those of chromogenic isolates. Differences between chromogenic and non-chromogenic isolates were not considered of taxonomic significance.

Isolates of Macrophomina phaseoli were separated into two groups based on their appearance on agar media, predominantly black, with appressed mycelium and abundant sclerotia, or predominantly gray, with more aerial mycelium and fewer sclerotia. Intermediate types were also found. Isolates were not always genetically stable for this character.

Isolates of Macrophomina phaseoli varied considerably in their pathogenicity on soybean, although none possessed a high degree of pathogenicity on that host. Infection was limited to young seedlings, senescent plants, inoculated plants, and plants growing under extremely unfavorable environmental conditions.

Symptoms of a previously unreported seedling blight on soybean were described. The most conspicuous symptom was a tan to reddish-brown lesion occurring on the stem between the soil line and the cotyledonary node. When germination and emergence were delayed by unfavorable soil conditions, increased amounts of seedling infection occurred. Variations in susceptibility to infection were correlated with differences in seedling vigor.

Soybean plants killed by the root and stem rot phase of charcoal rot characteristically developed a shepherd's crook curvature at the apex of the stem. Sclerotia of the fungus occurred abundantly, especially in the pith and cortex, in diseased plants. Low soil moisture levels were a major factor contributing to the development of the disease in both commercial plantings and greenhouse experiments. The disease was found in commercial plantings only in a season of severe drought and high temperatures in fields in which droughty conditions were aggravated by other factors. The disease occurred most commonly on very sandy soils, in drillseeded fields, in weedy fields, and at the borders of fields. Varietal variations in susceptibility to the disease were believed to be of no significance. Because of the weak pathogenicity of Macrophomina phaseoli on soybean, losses to the disease may be anticipated only in seasons of rather severe drought. Clean cultivation and planting in rows were suggested as measures for reducing losses to the disease in fields on very sandy soils.

#### REACTION RATES IN SULFONATION OF BENZENE BY SULFURIC ACID

(Publication No. 1181)\*

Robert Creighton Crooks, Ph.D. University of Michigan, 1949

A laboratory scale process unit of all-glass construction was designed and built for the purpose of measuring the rates of reaction between benzene and sulfuric acid. The method of continuous flow was employed to permit the measurement of reaction rates under steady-state conditions. Benzene vapor was bubbled through and intimately mixed with the sulfuric acid solution in a flow-type reaction cell. The reaction cell was provided with a multiple-propeller stirrer, and was mounted in a constant temperature bath. Calibrated reservoirs and receivers were employed for the measurement of materials flowing into and out of the reaction cell.

The rates of reaction between benzene and sulfuric acid in benzene-saturated solutions were measured at temperatures of 90°, 100°, 120° and 140° C. The reaction rates varied over a range of 0.239 to 15.81 moles of benzenemonosulfonic acid formed per hour per liter of solution, representing in the solution a concentration range of 2.53 to 41.83 per cent by weight of benzenemonosulfonic acid product.

A study of the effect of stirrer speed on the rate of reaction showed that the degree of agitation employed was sufficient to maintain the reaction solution saturated with respect to benzene.

The specific rate of reaction correlates as an exponential function of the solution composition and as a logarithmic function of the absolute temperature, and may be expressed as

$$\frac{R_L}{C_A} = 118 (x_A - \frac{1}{2} x_W + \frac{1}{4} x_S)^{-9.239 + \frac{5349}{T}}$$

where, R<sub>L</sub> = moles benzenemonosulfonic acid formed, per hour, per liter solution

 $C_{A}$  = moles  $H_{2}SO_{4}$  per liter solution

<sup>\*</sup> Microfilm copy of complete manuscript of 99 pages, \$1.24. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-390.

 $x_A = \text{mol fraction } H_2SO_4$ 

 $x_{W} = mol fraction H_2O$ 

x<sub>s</sub> = mol fraction benzenemonosulfonic acid

T = absolute temperature, degrees Kelvin.

This correlation is in agreement with the "pi-value" concept, which states that there is a critical concentration of sulfuric acid below which the reaction will not proceed. In the case of benzene sulfonation, the lower critical concentration corresponds to the hydrate  $\rm H_2SO_4 \cdot 2H_2O$ .

The reaction is shown to be of the first order with respect to the sulfuric acid concentration. The presence of the product, benzenemonosulfonic acid, is shown to increase the rate of reaction.

The solvent effect on the rate of benzene sulfonation is interpreted as due to hydration reactions occurring in the solution medium. This viewpoint was applied to the data of a similar reaction system, the mononitration of toluene by mixed acid, and the rates of toluene nitration were correlated by the same method. The specific rate of toluene mononitration at a temperature of 95° F. was found to correlate as an exponential function of the solution composition, and may be expressed as

$$\frac{R_{N}}{x_{T}C_{N}} = 2,520,000 \quad (x_{N} + \frac{5}{3} x_{A} - \frac{1}{3} x_{W})^{8.08}$$

where, R<sub>N</sub> = moles mononitrotoluene formed per hour, per liter of acid phase

 $C_N$  = moles HNO3 per liter acid phase

x<sub>T</sub> = mol fraction toluene in organic phase, acid-free basis

 $x_N = mol fraction HNO3 in acid phase$ 

 $x_A$  = mol fraction H<sub>2</sub>SO<sub>4</sub> in acid phase

 $x_{W}$  = mol fraction H<sub>2</sub>O in acid phase.

PART A. THE INFLUENCE OF EXCESS IONS ON THE ADSORPTION OF DYE IONS ON CRYSTALLIZED SILVER BROMIDE AND LEAD SULFATE PART B. SOLUBILITY AND ELECTRICAL CONDUCTANCE OF SOME LITHIUM SALTS IN ETHYL ETHER

(Publication No. 1169)\*

Jean Chien-Han Chu, Ph. D. University of Michigan, 1944

#### A

The amounts of dye ions adsorbed on crystallized silver bromide and lead sulfate in the presence of excess lattice ions were studied by means of a Hilger-Nutting spectrophotometer. The dye anions of eosin and erythrosin were used in the case of AgBr as adsorbent, those of wool violet 4BN and chromotrope F4B for PbSO<sub>4</sub>.

In confirmation of previous results, it was found that an excess of lattice anions in the solution suppresses in every case studied the adsorption of the dye anions, and the saturation values of adsorption decrease with increasing concentration of the lattice anions. On the other hand, excess lattice cations cause an increase of the adsorption of the dye anions and the saturation values increase with increasing concentration of the lattice cations. Furthermore, it has been shown that a sufficient excess of KBr can completely displace erythrosin anions from the AgBr surface, while bromide ions cannot be completely displaced even by high concentrations of erythrosin. This is explained by the relatively large size of the dye anions. The negatively charged groups of the dye are attached only to part of the silver ions of the surface, while the other silver ions can adsorb the smaller bromide ions.

These results and the peculiar influence which excess AgNO<sub>3</sub> exerts on the adsorption of the basic dye phenosatranine on AgBr are in accord with the addition mechanism according to which the adsorbed dye ions are deposited on the oppositely charged ions on the surface of the adsorbent.

<sup>\*</sup> Microfilm copy of complete manuscript of 167 pages, \$2.09. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-378.

#### B

In order to investigate the state of anhydrous lithium perchlorate in solutions of exceptionally high concentrations in ethyl ether and acetone, electrical conductances of these solutions were measured at 25° C. The investigation was extended to the solubilities and conductances of anhydrous lithium fluoborate and lithium halides in ether.

It was found that LiF and LiCl are not appreciably soluble in ether, whereas LiBF4, LiBr and LiI dissolve at  $250^{\circ}$  C. respectively to the extent of 0.207, 1.70 and 5.172 m (Moles salt per 1000 gm. of ether) as compared with the value 10.60 m of Willard and Smith for LiClO4. The electrical conductances of LiBr and LiBF4 in ether are too small to be measured accurately. The molar conductances (in ohm<sup>-1</sup> cm<sup>2</sup>) of LiI increase from 8.5 x  $10^{-4}$  to 1.4 x  $10^{-3}$  (in ohm<sup>-1</sup> cm<sup>2</sup>) in the concentration range 0.65 - 3.47 M (mol/liter solution). The molar conductances of LiClO4 in ether increase from 1.61 x  $10^{-3}$  at 0.61 M to a maximum value 1.11 x  $10^{-1}$  at 3.56 M and then decrease to 5.17 x  $10^{-2}$  at 6.02 M. The molar conductances of LiClO4 in acetone decrease from 34.0 to 0.824 ohm<sup>-1</sup> cm<sup>2</sup> in the range 1.06 - 5.12 M.

The concentration dependence and the absolute values of the conductances show that in acetone LiCIO<sub>4</sub> forms the ions Li<sup>+</sup> and CIO<sub>4</sub><sup>-</sup> and that the degree of dissociation is about 0.2 in a 1 M solution. On the other hand, in etheric solutions the degree of ionization is very small and the sharp increase of the molar conductance with increasing concentration up to the maximum shows that the ionization is due mainly to the formation of complex ions (LiCIO<sub>4</sub>)<sub>x</sub>Li<sup>+</sup> and (LiCIO<sub>4</sub>)<sub>y</sub>CIO<sub>4</sub><sup>-</sup>, with x and y having values around four. The decrease of the conductance at still larger concentrations must be due to the high viscosity of these solutions. This behavior of the etheric solutions of LiCIO<sub>4</sub> and the fact that in its saturated solutions in ether, acetone and ethyl acetate only about five moles of the solvent are present per four moles of salt indicate that its neutral molecules associate to complexes (LiCIO<sub>4</sub>)<sub>n</sub>.

## MOLAR REFRACTION AND ALTERNATING POLARITY IN ALKYL CHAINS

(Publication No. 1171)\*

Beth Elain Cook, Ph.D. University of Michigan, 1949

Six symmetrical germanium tetraalkyls from  $Ge(CH_3)_4$  to  $Ge(n-C_6H_{13})_4$  were prepared, their refractive indices, densities, and viscosities measured, and the molar refractions, dispersions, and volumes evaluated. The apparent molar refraction, dispersion, and volume increments,  $R_{CH_2}$ ,  $D_{CH_2}$ , and  $V_{CH_2}$ , for successive methylene groups, i.e. one-fourth the difference of the R, D, and V values of successive members of the series, were calculated. The increments were found to alternate between low and high values, the extremes for  $R_{CH_2}$  being 4.53 cc. for Et-Me and 4.75 cc. for Pr-Et.

Literature data on the tetraalkyls MR<sub>4</sub> of other Group IVb elements show qualitatively the same kind of alternation in the three kinds of increments as far as information is available. On the other hand, in compounds of the type M(YR)<sub>4</sub> (Y = oxygen or sulfur) the Et-Me increments are higher than the Pr-Et increments, and any alternation in the remainder of the chain is opposite in sense to that in the tetraalkyls.

This reversal in the sense of the gradation of increments, due to the interposition of negative oxygen or sulfur between a positive central atom and an alkyl chain, is interpreted as proof of the difference in sign of charges of methylene groups attached to positive or negative centers. The alternation of increments is considered to be due to alternating polarity of successive  $CH_2$  groups in the chain. According to the quanticule theory of molecular structure, recently developed by K. Fajans and associates, these groups are assumed to be  $(CH_2)^{2+}$  and  $(CH_2)^{2-}$ , and the two kinds of compounds are formulated as, e.g.,

$$\begin{array}{c} {\rm Ge^{4+}} \left[ ({\rm CH_2})^{2-} ({\rm CH_2})^{2+} {\rm CH_2})^{2-} ({\rm CH_3})^{+} \right]_{\rm 4~and} \\ {\rm Si^{4+}} \left[ {\rm S^{2-}(CH_2)^{2+}(CH_2)^{2-}(CH_2)^{2+}(CH_3)^{-}} \right]_{\rm 4} \ . \end{array}$$

<sup>\*</sup> Microfilm copy of complete manuscript of 160 pages, \$2.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-380.

The character of the alternation of  $R_{CH_2}$  and  $V_{CH_2}$  values, observed or strongly indicated by two successive increments, in alkyl chains R points to a central  $C^{4+}$  in series such as  $R_2C$  (COOEt)2 and  $R_2C(CH_2COOEt)2$ , but to a central  $C^{4-}$  in the series  $C_6H_{11}(CH_2)_xCR(COOEt)_2$ , and to  $(CH)^{3-}$  in the compounds  $CH_3CO$  (CH)RCOOEt. No alternation is found in alkyl chains attached to a carbalkoxy or carbonyl group, or to  $OH^-$ ,  $Cl^-$ , or  $Br^-$ . In chains attached to oxygen, the Et-Me increments are somewhat higher than the Pr-Et values, although further increments have been found to alternate only in the  $C_6H_5OR$  series.

The increments were found to vary between 3.89 and 5.72 cc. for  $R_{CH2}$ , 12.6 and about 21 cc. for  $V_{CH2}$ ; most of the former increments fall between 4.3 and 5.0 cc., most of the latter between 16.0 and 17.5 cc. In general, the great variations are limited to series in which alternation occurs. In numerous other series the  $R_{CH2}$  increments are near the average value 4.64 cc. found in

normal hudrocarbons.

The assumption of the occurrence of alternate  $(CH_2)^{2+}$  and  $(CH_2)^{2-}$  groups appears to be necessary in order to explain the pronounced alternation of  $R_{CH_2}$  and  $V_{CH_2}$  increments in parts of alkyl chains which are far from the polar center responsible for the alternation. On the other hand, the variations of the  $R_{CH_2}$  and  $V_{CH_2}$  values of groups concluded to have the same configuration are considered to be due to polarizing influences of other parts of the molecules.

#### SEMIMICRO METHODS FOR QUANTITATIVE ANALYSIS

(Publication No. 1224)\*

Shirley Walter Gaddis, Ph.D. University of Missouri, 1947

This study had for its object the investigation of the possibilities of teaching the beginning course in Quantitative Analysis by semimicro methods. The experimental part of this study was the devising and testing of semimicro procedures for carrying out the seven determinations most frequently used in the beginning courses. The determinations selected are listed in Table 1.

Certain objectives were kept in mind in devising the semimicro procedures: The procedure should be as accurate but less

<sup>\*</sup> Microfilm copy of complete manuscript of 70 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-24.

time-consuming than the macro method; the techniques employed should be easy to demonstrate and perform; starting samples should weigh from 50 mg to 100 mg; and all weighings should be done on an ordinary analytical balance.

The first part of the dissertation gives detailed directions for the semimicro methods for doing the determinations selected. The second part of the dissertation is a tabulation of the precision and accuracy attained in each of the seven determinations. Table 1 summarizes these data. The dissertation concludes with discussion of the meaning of the magnitude of the errors incurred in the various procedures. The precision realized was of the same order of magnitude as the precision predicted from theoretical considerations.

Unknown samples as supplied to students were used in this study. Around nine runs were made to test the precision and accuracy of the proposed semimicro procedures. Table 1 shows the results. All numbers in Table 1 are expressed as parts in 1,000 parts (thus,  $3^{\circ}/\circ$ 0).

Table 1: Precision and Accuracy of the Semimicro Methods

Determination	Range of the	Range of the
R	elative Mean Errors	Relative Mean Deviations
Chloride	.5 to 1	1 to 2
Soda Ash	1 to 3	1 to 4
Sulfate	1 to 4	1 to 3
Iron	1 to 2	1 to 3
Volumetric Calcium	0 to 5	2 to 3
Antimony in Stibnite	1 to 2	2 to 6
Argillaceous Limest	cone	
Loss on Ignition	1	1
Silica	2	3
<b>Mixed Oxides</b>	14	16
Magnesium Oxide	27	30
Calcium Oxide	0	3

The results of this study encourage us to believe that semimicro methods could be used for the teaching of Quantitative Analysis. We believe that the gravimetric determination of chloride, sulfate, and limestone could be done by beginning students more efficiently by the semimicro methods described in this dissertation than by the present-day macro methods. However, we feel that the volumetric procedures demands the use of techniques that might require considerable time to teach to the student, hence there would be no saving in time over the present macro methods.

#### KINETICS AND MECHANISM OF PINACOL REARRANGEMENTS

(Publication No. 1286)\*

Harry Sello, Ph. D. University of Missouri, 1948

The rate constants for the rearrangement of cis and trans 7, 8-diphenylacenaphthenediol-7,8 have been determined in the range 0.3 to 60 mol per cent water in acetic acid at 25°, 50° and various concentrations of catalyst. The net reaction observed, may be written as follows:

Both pinacols follow first order kinetics over the entire range of water concentration observed. The rearrangement of the cis pinacol is faster at all water concentrations than the trans pinacol by a factor of approximately 3 times at 25° and 3 - 6 times at 50°. Water causes both reactions to slow down in exponential relationship, while the catalyst activity is directly proportional, linearly, to the rate constants at constant water concentration.

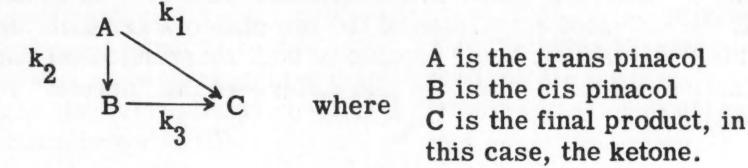
For the cis pinacol there is an entropy increase on activation as compared to a relatively large decrease in the activation entropy of the trans pinacol rearrangement. Moreover, with increasing water concentration, the entropies of activation diverge; for the cis, there is a general decrease and for the trans, a corresponding increase. This divergence suggests different mechanisms of rearrangement leading to the same final product.

In addition, a proposed mechanism must account for the fact that cis pinacol has been isolated from a reaction mixture starting with only trans pinacol<sup>1</sup>.

<sup>\*</sup> Microfilm copy of complete manuscript of 107 pages, \$1.34. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-86.

<sup>1</sup> Bartlett and Brown, J. A. C. S. 62, 2930 (1940).

As a result of this investigation, a mechanism is postulated which may be written as follows:



with  $k_1$ ,  $k_2$ , and  $k_3$  as the rate constants of the trans rearrangement, isomerization and cis rearrangement respectively. Since step  $A \rightarrow B$  involves the breaking of carbon-carbon bonds, it does not seem too unlikely that  $A \rightarrow C$  may also simultaneously take place. The rate measurement of the cis pinacol yields values of  $k_3$  independently while the trans rate measurement gives values of  $k_1$  and  $k_2$  combined. By integration of the proper differential equations for the various steps in the reaction, an exact equation may be derived to express the total pinacol ( $A \neq B$ ) as a function of initial conditions and times

$$A + B = \frac{k_2 A_0}{K - k_3} \left( e^{-k_3 t} - e^{-kt} \right) + A_0 e^{-kt}$$

where  $A_0$  is the initial amount of pinacol and  $K=k_1 \neq k_2$ . From rate data substitutions may be made for  $k_3$ ,  $A \neq B$  and  $A_0$ , resulting in simultaneous equations from which a value of  $k_2$  and subsequently  $k_1$ , may be found.

In all cases, k3 is larger than k1 or k2 so that the smaller value of k<sub>1</sub> or k<sub>2</sub> will be the rate determining step. At low concentrations of water and at both temperatures, k1 is of the same order of magnitude as k2, falling away rapidly with increasing water concentration. While k1 also decreases, it approaches closely the experimentally net measured rate. Thus, while water hinders both the isomerization and rearrangement steps, its effect on  $B \rightarrow C$  is greater. The entropies and heats of activation for the analogous steps denoted by k1 and k3 differ quite markedly. At the lowest water concentration,  $\Delta S^*$  for step A  $\rightarrow$  C is negative, while for  $B \rightarrow C$ ,  $\Delta S^{\dagger}$  is positive. Both entropy values increase with increasing water concentration. The larger positive  $\Delta S^{\dagger}$ , hence the faster rate, exhibited by the cis pinacol is due to the fact that the two phenyl groups are on the same side of the molecule and sterically hindering each other from freely rotating about the single bond. Upon activation, these groups are loosened, can rotate and thus increase  $\Delta S^{\dagger}$ . The trans pinacol, however, has these phenyl

groups of opposite sides freely rotating at the start of the activation, so that its  $\Delta S^{\dagger}$  is a much smaller positive quantity.

Thus, the thermodynamic data obtainable from rate data, indicate that the activated complexes of the two pinacols are quite different, the trans isomer being capable of both rearrangement and isomerization, while the cis form just undergoes the "normal" rearrangement.

## THE ABSORPTION SPECTRA OF SOME P-AMINOARYLDIAZONIUM DERIVATIVES

(Publication No. 1207)\*

John Wesley Steedly, Jr., Ph.D. University of Michigan, 1949

The object of this investigation was to obtain evidence of quinoidation of the p-diazoimines and p-aminoaryldiazonium salts from quantitative absorption spectra and to determine the extent of dissociation of the "stabilized" complex metal salts of the p-aminoaryldiazonium salts into diazonium ions in water solution.

Absorption of visible light was measured by the use of a Nutting photometer and a Hilger spectrograph using a pointolite lamp as a source of light. Ultra-violet light absorption was measured by the use of a Judd-Lewis sector photometer and a Hilger quartz spectrograph with a condensed spark between tungsten electrodes in doubly distilled water as the source of light.

Quantitative absorption spectral curves are presented for N-phenyl-p-phenylenediazoimine and carbazole-3-diazoimine in ether and in water solutions; and p-phenylenediazoimine and N-methyl-p-phenylenediazoimine in water solutions. By comparison of these curves with the curve for diphenylquinomethane in ether, it is seen that all of these substances have their first or conjugated absorption band in the same region of the spectrum and the conclusion is reached that the p-diazoimines possess a "quinonoid" structure, that is, the quinonoid formulations contribute to a large extent towards the resonance hybrid representing the true structure of the molecules, and therefore the conventional structural formula for these compounds should be written as shown below in (A).

$$H - N = \left( \frac{1}{A} \right) = N \equiv N$$

<sup>\*</sup> Microfilm copy of complete manuscript of 77 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-8.

From a comparison of the quantitative absorption spectral curves for the p-aminoaryldiazonium salts with the corresponding p-diazoimines, it is concluded that the p-aminoaryldiazonium salts likewise possess a quinonoid structure, that is, the quinonoid formulations contribute to a large extent towards the resonance hybrid representing the true structure of the molecules and therefore the conventional structural formula should be written as shown below in (B).

CI 
$$H_2^+N = \bigcirc$$
 =  $N \equiv N$ 

Quantitative absorption spectral curves were obtained for p-amino-benzenediazonium chloride, p-N-methylaminobenzenediazonium chloride, p-dimethylaminobenzenediazonium chloride, p-phenyl-aminobenzenediazonium sulfate and carbazole-3-diazonium chloride.

The quantitative absorption spectral curves for a number of complex metal salts (ZnCl<sub>2</sub>, SbCl<sub>3</sub>, and HgCl<sub>2</sub>) of the above p-aminobenzenediazonium salts were determined and in all cases investigated these complex salts were found to give identical absorption spectral curves to those obtained for the simple diazonium salt in water solution. It is concluded therefore that the metal complex salts of the p-aminobenzenediazonium salts in water solution are completely dissociated into diazonium ions within the accuracy of the method used for determining the quantitative absorption spectra.

The structures of the p-diazoimines and p-aminoaryldiazonium salts are discussed in terms of the resonance theory and a mechanism of formation of the p-diazoimines is presented.

## THE RARE EARTH METALS AND THEIR COMPOUNDS. THE NORMAL AND MODIFIED ACETYLACETONATES

(Publication No. 1268)\*

Joseph Gant Stites, Jr., Ph.D. Michigan State College, 1949

The acetylacetonates of La, Ce, Pr, Nd, Sm, Eu, Y, and Th have been prepared in good yields and in a state of high purity by precipitating from solutions of controlled acidity. Chlorides or nitrates of the respective rare earths were dissolved in water and ammonium acetylacetonate solution added slowly. The pH of the solution was maintained at a value just below that for the precipitation of the respective rare earth hydroxide. Yields of rare earth acetylacetonates from 88 per cent to 100 per cent were obtained. The melting points of the products obtained even before purification compared favorably with the melting points reported in the literature.

Trifluoroacetylacetonates of several rare earths were also prepared in a state of high purity but not in as good yield as was obtained for the normal acetylacetonate.

Titration studies of several of the rare earth metals, copper, zinc, and nickel, have been made in the presence of acetylacetone and less comprehensively in the presence of thenoyltrifluoroacetone, trifluoroacetylacetone, and ethyl trifluoroacetonacetate.

These titrations were made using the technique of Calvin, i.e., dissolving the metallic salt and chelating agent in 100 ml. of 50 per cent water — 50 per cent dioxane solution and adjusting the pH of the resulting solution to some arbitrarily determined value (pH 1.80). The solution was then titrated with standard alkali and the pH determined using a Beckman Model G pH meter. Sufficient time was allowed between successive additions of alkali to attain equilibrium, since there are differences in the behavior of the metal ions in fast and in slow titrations.

The pHs of formation of the acetylacetonates of the metals have been observed to be different from the pHs of formation of the respective hydroxides. The formation of the chelated compounds proceeds in a step-wise manner from coordination in highly acid solutions, through the removal of protons from coordinated

<sup>\*</sup> Microfilm copy of complete manuscript of 124 pages, \$1.55. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-68.

chelating agent molecules to the precipitation of the chelate. There apparently is no complete hydrolysis of the chelates to the hydroxides in highly alkaline solutions.

Thenoyltrifluoroacetone forms the more stable chelated compound with the rare earths than any of the other chelating agents used.

Copper apparently forms planar molecules with acetylacetone while zinc and nickel form tetrahedral molecules. There is a very noticeable discrepancy between the behavior of copper in the presence of chelating agents and the behavior of zinc and nickel.

There is only a very small difference in the pHs of precipitation of the several rare earth acetylacetonates. Apparently the rare earth ions lose much of their individual identity when they are the central atom of a coordination complex.

The behavior of chelated compounds of the rare earth metals in solutions of varying acidity has been studied, better methods of preparation of the chelate compounds have been devised, and the relative chelating strengths of various chelating agents have been observed.

#### HYDRODIETHYLSTILBESTROL COMPOUNDS III

(Publication No. 1227)\*

Paul William Tucker, Ph.D. University of Missouri, 1948

Since the discovery, in 1939, of hexestrol as a highly potent estrogen, there has been considerable interest and activity in an attempt to find a synthetic androgen. In view of the relationship between estrone and androsterone, it was thought that partially hydrogenated stilbestrol compounds might exhibit androgenic activity and this investigation was accordingly undertaken.

The first part of the investigation deals with the partial hydrogenation of meso-dihydrodiethylstilbestrol over a Raney nickel catalyst and a crystalline product, m.p. 127-128°, was isolated from the phenolic material. It was recovered unchanged from its benzoate, m.p. 123.5-125° and was tentatively assigned the transconfiguration on the basis of its single perhydrogenation product, meso-3,4-di-(4<sup>t</sup>-hydroxy-cyclohexyl)-hexane, m.p. 166-167°.

<sup>\*</sup> Microfilm copy of complete manuscript of 54 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-27.

The identity of this octahydro compound with that of Wilds is discussed.

The meso-octahydro ketone, meso-3(4-hydroxy-phenyl)-4-(4-ketocyclohexyl)-hexane was prepared by the Oppenauer oxidation of the crude phenolic mixture from the partial reduction of meso-dihydrodiethylstilbestrol and hydrogenated to give a mixture of cis- and trans-isomers of meso-octahydrodiethylstilbestrol.

The second phase of this investigation is concerned with the preparation of the unsaturated ketones in the meso- and racemic-stilbestrol series. Unsaturated ketones in both the meso- and racemic-series were prepared from the corresponding saturated diketone by brominating the diketone followed by dehydrobromination. One, two, or three bromine atoms may be introduced into the diketone by brominating with bromine and acetic acid, or preferably, by the use of N-bromosuccinimide in carbon tetrachloride. Dehydrobromination with collindine gave the following ketones after purification by chromotographic separation and molecular distillation.

#### Meso-series

# O= CH-CH =O

#### Racemic-series

The third part represents a reinvestigation of the racemic-octahydrodiethylstilbestrol compounds. The monomethyl ether of racemic-hexestrol was prepared and reduced over copper chromium oxide at 250° and 430 atmospheres. It was demethylated by heating with methyl magnesium iodide at 185-195° for two and one-half hours to give a mixture of cis- and trans-isomers of racemic-octahydrodiethylstilbestrol.

Benzoates were prepared for all of the octahydro compounds.

The spectra of all of the compounds were determined.

Preliminary physiological results indicate no androgenic activity for the octahydro compounds.

#### THE INFRARED ABSORPTION SPECTRUM OF DIBORANE

(Publication No. 1167)\*

Wallace Ervin Anderson, Ph.D. University of Michigan, 1949

The molecular structure of diborane, B<sub>2</sub>H<sub>6</sub>, has been a perplexing problem of structural chemistry. On elementary considerations the twelve valence electrons present are sufficient for binding the hydrogen and boron atoms with normal single bonds of electron pairs, leaving none for binding together the boron atoms.

Alternate structures postulated for  $B_2H_6$  are the ethane-like structure, symmetry point group  $D_{3h}$  or  $D_{3d}$ , and the ethylene-like bridge structure, point group  $V_h$ , which assumes two  $BH_2$  groups in one plane with a common symmetry axis through the boron atoms similar to  $C_2H_4$ . Each boron atom is linked also to two hydrogen atoms which lie on an axis midway between them and probably normal to the  $B_2H_4$  plane. Electron diffraction investigations and infrared and Raman vibrational spectra under low resolution are not conclusive in determining the correct structure.

In the present investigation several infrared absorption bands of diborane have been examined with resolution sufficient to reveal the rotational fine structure. Automatically recording grating spectrometers were used with overlapping orders prevented by filters and selective reflection or by a foreprism. The observed band types, designated as types A, B, and C, are correlated with the direction of variation of the electric moment. Exact similarity with the ethylene bands indicates that diborane is an asymmetric top molecule, symmetry point group Vh, with two hydrogen atoms forming a bridge between the boron atoms. This is the first instance for which this structure has been established. By analyzing the resolved band structures and the envelopes of all bands, an identification of normal vibrations and fundamental frequencies can be made. This assignment differs from that previously suggested and indicates that equations derived for the normal vibrations and force constants calculated therefrom are not entirely satisfactory. Positions of combination bands can be predicted with reasonable accuracy.

<sup>\*</sup> Microfilm copy of complete manuscript of 98 pages, \$1.23. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-376.

Analysis of the rotational fine structure on the symmetric top approximation yields accurate values for rotational constants B and  $(A - \tilde{B})$ , where  $\tilde{B} = (B + C)/2$ , and A, B and C are proportional respectively to the reciprocal of the least, middle and greatest effective moment of inertia. From type A bands at 1173.8 and 2519.5 cm-1, B for the ground state equals 0.579 and 0.583 cm-1 respectively. The isotope effect in these bands due to molecules B2<sup>11</sup>H<sub>6</sub> and B<sup>11</sup>B<sup>10</sup>H<sub>6</sub> causes the appearance of major and minor components in the central maxima.

In the type B band at 2608.6 cm<sup>-1</sup> and the type C band at 972.7 cm<sup>-1</sup>, series of "lines" can be identified and assigned to B2<sup>11</sup>H6 and B<sup>11</sup>B<sup>10</sup>H<sub>6</sub> respectively, and constants (A - B) computed for each. For B211H6 in the ground state the results are 2.081 and 2.079 cm<sup>-1</sup> respectively. Slightly different values are obtained for B<sup>11</sup>B<sup>10</sup>H<sub>6</sub>. The band at 1988.0 cm<sup>-1</sup> yields the less accurate result 2.116 cm<sup>-1</sup>, and the band at 368.7 cm<sup>-1</sup> the value 2.058 cm<sup>-1</sup>, both probably for B211H6.

Data on molecules B<sub>2</sub>D<sub>6</sub> and B<sub>2</sub><sup>10</sup>H<sub>6</sub> will be necessary for determining uniquely the molecular dimensions, and probably for deciding between planar and non-planar configurations.

#### THE POLAROGRAPHIC DETERMINATION OF ALUMINUM

(Publication No. 1187)\*

John Aurie Dean, Ph.D. University of Michigan, 1949

This thesis is divided into five parts.

The first part is a brief review of the fundamental principles involved in polarography. These include the phenomenon of the limiting current, the factors which affect the diffusion current, and the equation of a polarographic wave.

The second part is a brief description of the equipment used to

obtain the results included in this paper.

The third part of this paper is a discussion of the results obtained from the study of two dihydroxyl-azo dyes in the presence of aluminum ions. Aluminum may be quantitatively determined in the presence of either 4-sulfo-2-hydroxy-benzene-azo-beta-naphthol or 4-sulfo-2-hydroxy-naphthalene-azo-beta-naphthol preferably the former, because in these cases a second polarographic wave is

<sup>\*</sup> Microfilm copy of complete manuscript of 61 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-396.

formed and the diffusion current of the second of these two waves is directly proportional to the concentration of aluminum ions present in the solution. Hydrogen ions affect the magnitude of the diffusion current, as well as the half-wave potential of the diffusion wave. The optimum diffusion current is obtained in an acetate buffered solution adjusted to a pH of about 4.6. Heating the solution at 550 to 700 C. for a short period reduces to five minutes the time required to attain maximum diffusion current. Most heavy metal ions interfere, but these may be conveniently removed by electrolysis in a mercury cathode cell prior to the polarographic step. Among the metals not removed in the mercury cathode treatment, only titanium, vanadium, and the alkaline earths seriously interfere. The method is one of the few available for the determination of aluminum in the presence of beryllium.

The fourth part of this paper discusses the probable nature of the aluminum-dye compound responsible for the distinctive polarographic wave observed. It is postulated that the dyes may exist in two tautomeric forms: the quinone-hydrazone form, and the dihydroxyl-azo form. The former believed to be the form present in pure solutions of the dye buffered at pH 4.6, and also the form contributing the first wave of the combined waves found when aluminum ions are present in the solution. The second—dihydroxyl-azo—form is believed to be present only when stabilized by the replacement of both hydroxyl hydrogen atoms by aluminum ions. No previous example is known in which a metal ion stabilizes one of two tauotmeric forms, both polarographically reducible, and, thereby, establishes a quantitative procedure for that particular metal ion.

The fifth and final part of this paper is a description of the analytical procedure for the polarographic determination of aluminum in steels, bronzes, and minerals. For bronzes and steels the heavy metal ions are removed by successive electrolyses with a mercury cathode cell. For minerals the aluminum is separated first as the hydrous oxide, then any heavy metals which accompany this separation are removed by electrolysis in a mercury cathode cell. The only diverse ions present in the final solution in appreciable amounts should be sodium and perchlorate ions. The residual solution, or a suitable aliquot containing between 0.05 and 0.40 mg. aluminum per 50 ml., is mixed with 2.5 x 10<sup>-5</sup> moles of dye and buffered with an acetic acid-sodium acetate mixture at a pH of 4.6. After a short heating period, the solution is cooled to 250 C., the dissolved oxygen removed, and the polarogram is recorded between -0.1 volt and -0.8 volt using the saturated calomel electrode. The results are evaluated by the absolute method after a correction has been applied for a "zero" current of unknown origin. The method yields good results with standard samples of steels and bronzes, but only fair results when applied to minerals.

## THE ARRANGEMENT OF MOLECULES IN MONOLAYERS AND MULTILAYERS OF ORGANIC ACIDS

(Publication No. 1243)\*

Herman Theodore Epstein, Ph.D. University of Michigan, 1949

The primary purpose of the investigation is the determination of the arrangement of polar hydrocarbon molecules in monolayers and in multilayers. It is also proposed to repeat a variety of experiments previously performed on such layers and to examine the results with the electron microscope. The examination will, it is hoped, provide verification of the ideas based on previous work on such layers, and perhaps reveal new features not suspected from the previous indirect methods of studying the layers.

The work is done with layers of the fatty acids, primarily with stearic acid. The layers are prepared on glass and on collodion, and are shadowcast with U or Pt before examination in the electron microscope.

It is first verified that shadowcasting leaves the molecules oriented as they are before shadowcasting by measuring the heights of the layers and finding that the results agree with those found by previous indirect, but more accurate optical measurements.

The main result of the work derives from the finding that the molecules are grouped in clusters (to be called micelles) about 100 A in diameter. The substrates are too rough to permit a direct conclusion that the micelle structure is characteristic of the layers. However, it is shown that the results of many previous experiments can be interpreted and correlated with each other on the basis of the existence of micelles.

A theory of the internal structure of the micelles is developed. It is proposed that because the polar groups are larger in cross-section than the so-called tails of the molecules, the molecules lean toward each other. Thus, in a micelle, the mulecules lean in toward the center of the micelle, the leaning increasing with the distance of a molecule from the center. In this fashion, the experimentally found tilts of the molecules are explained. Because the molecules slip along each other due to the tilting, there is a

<sup>\*</sup> Microfilm copy of complete manuscript of 104 pages, \$1.30. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-43.

decrease of cohesive energy. Eventually some molecules would have to tilt so much that it becomes energetically profitable to form a second micelle rather than to join on to the first one.

The theory developed on the basis of the model described predicts that the micelle diameter and the maximum tilt of the molecules vary inversely with the length of the molecule. Electron microscopy of monolayers of molecules of a series of lengths verifies that the micelle diameter varies inversely with the molecule length. Electron diffraction work by Mr. W. C. Bigelow verifies the inverse relation between the maximum molecular tilt and the molecule length.

A number of other experiments are carried out on layers deposited off water surfaces, on oleophobic layers, and on skeletonized films.

The findings lead to the conclusion that the internal structure of monolayers and multilayers is now known, and a model for their structure is available to guide further work on the properties of the layers.

## ARTIFICIALLY PRODUCED RADIOISOTOPES OF TUNGSTEN AND RHENIUM

(Publication No. 1262)\*

William H. Sullivan, Ph.D. University of Michigan, 1946

An investigation of the radioactivity induced artificially in tungsten and rhenium was conducted, using the Michigan cyclotron as a source of slow and fast neutrons and deuterons for producing various possible nuclear reactions. Several different sources of tungsten and rhenium, with and without purification before irradiation, were used for the experiments. Subsequent to irradiation chemical operations were conducted, in practically all cases, to separate and purify the several radio-elements produced.

The basic chemical procedure for separating tantalum and rhenium from irradiated tungsten consisted of dissolving the tungsten consisted of dissolving the tungsten in a mixture of hydrofluoric and nitric acids, diluting, precipitating tantalum as tantalic hydroxide, filtering, acidifying slightly, precipitating rhenium as tetraphenylarsonium perrhenate, filtering, then precipitating

<sup>\*</sup> Microfilm copy of complete manuscript of 128 pages, \$1.60. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-62.

tungstic acid from a boiling solution after further acidifying with hydrochloric acid. A number of variations of this procedure, together with other chemical methods, were also employed.

The instruments used for the experimental studies included two Lauritsen electroscopes, a modified Wulf string electrometer, and two Geiger-Mueller counters, which were fitted with the hydrogen-filled bubble-type counter tubes.

The energies of the beta and gamma radiations were determined from absorption measurements, using aluminum, copper, and lead absorbers. In some studies a cloud chamber was used to determine the sign of the emitted particles and to examine the spectra of the beta particles.

The experimental results may be summarized as follows: A new tungsten isotope of  $74^{\frac{1}{2}}$  2 day half-life was discovered coincidentally with Minakawa. Only a beta radiation of maximum energy  $\sim 0.6^{\frac{1}{2}}$  0.05 MeV was found and the intensity of any gamma radiation present was at least 3000 times weaker than that of this beta radiation (extrapolated to zero thickness of aluminum absorber).

The shorter-lived tungsten isotope, discovered by Amaldi, et al, was found to have the half-life of  $24.1 \pm 0.2$  hours and to emit beta rays of maximum energy  $1.4 \pm 0.1$  Mev and  $\sim 0.5$  Mev. The maximum energy of its gamma rays was found to be 0.87 Mev by absorption measurement in lead. The 74-day and 24-hour tungsten isotopes were assigned to W<sup>185</sup> and W<sup>187</sup>, respectively, after examining data concerning the relative ease of their formation by slow and fast neutron reactions.

Attempts to find an activity which might be due to  $W^{181}$  were unsuccessful.

A 50-day rhenium activity was discovered. It was produced by the deuteron bombardment of tungsten and the fast neutron bombardment of rhenium. In order to assign its mass number, it was necessary to test isotopic assignment by F. Yamasaki and K. Sinma of the  $90.3 \pm 1$  hour activity to  $Re^{186}$  and of the  $18 \pm 1$  hour activity to  $Re^{188}$ . The given values of their half-lives were determined on activities induced in rhenium with slow neutrons. By measuring the relative ease of formation of these two radio-isotopes under slow and fast neutron irradiation the above isotope assignment was found to be valid. This led to the assignment of the 50-day activity to  $Re^{184}$ .

The 50-day rhenium isotope was found by absorption methods to emit two groups of electrons of 0.22-0.26 Mev and 0.86-0.94 Mev energy and gamma rays of 1.05 Mev. The 0.86-0.94 Mev electron radiation appeared to be due to the internal conversion of the 1.05 Mev gamma ray, while the 0.22-0.26 Mev electron radiation appeared to originate in the nucleus. Thus, this radio-isotope appears to decay by both beta disintegration and orbital electron capture.

## TESTS OF CONCEPTS OF THE GROWTH OF CHILDREN AS WHOLES FROM THE DATA OF THE HARVARD GROWTH STUDY

(Publication No. 1179)\*

Ralph Leo Witherspoon, Ph.D. University of Michigan, 1949

The investigation was undertaken to test and verify concepts of the growth of children as wholes as developed in published and unpublished studies by Olson and Hughes at the University of Michigan. The thought was that the range of generality might be limited or extended by applications of the same methods to another sample of the population.

The concepts selected for testing included: (1) the unity of growth, (2) the predictability of growth, and (3) the existence of familial patterns for growth.

The general procedure was to apply the age unit method for describing longitudinal data to a sample of children from the Harvard Growth Study. Generalized age-equivalents determined from measurements of all children in the Harvard Study were first applied to the sample and to the same population regrouped as early and late-growers and by sex. Next, age-equivalents based on Shuttleworth's maximum growth groupings of the Harvard population were applied to see whether synchronization for age of maximum increment in height would make more pronounced any of the trends found. Certain familial patterns of growth were studied in relation to the concepts tested. Longitudinal graphical presentations were used throughout the text to verify and illustrate the findings.

Forty-six cases, who had siblings with comparable data, were selected as early and late-growers. In order to study certain twins it was necessary to include 8 middle-grower girls. Seriatim measurements of the following variables were available for each child for ages six through seventeen: Standing height, body weight, age of eruption of permanent teeth, skeletal age, mental age, and the mean growth value or organismic age.

Unity, or homogeneity, of growth was considered to be present when the average deviation of growth attributes (A.D.) about a

<sup>\*</sup> Microfilm copy of complete manuscript of 331 pages, \$4.14. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-388.

child's own organismic age (O. A.) was found to be smaller than the average deviation of the child's growth attributes about the mean organismic age of the group of which the child is a part (A.D.'). Predictability, or continuity of growth was taken as evident when a high and reliable positive value of r for the variable in question was found for measurements at age 10 and 15. Although the statistical treatment did not include all the possibilities, the existence of familial patterns of growth was further illustrated by graphical representations of the several variables for four corresponding pairs of sister-sister twins.

The tests of homogeneity revealed that 40 of the 46 children were more homogeneous in growth than the group of which they were a part. Four were equally homogeneous. Homogeneity of growth was firmly established for the total sample and for all groups. Greater variability was evident during the pre-adolescent and adolescent growth cycles which appeared from one to two years earlier for girls than for boys and for early-growers than for late-growers.

A high degree of continuity and predictability of growth between the adolescent years of 10 and 15 were evident for all variables with the exception of dental and iliac ages. Graphical representations of each variable and of organismic age for corresponding pairs of sister-sister twins showed a high degree of continuity and similarity of level and pattern of growth when presented simultaneously. Simultaneous longitudinal representation of growth attributes and of total growth patterns is unquestionably one of the significant contributions to an analysis of the growth process.

Contrary to initial expectancy, tests of hypotheses based on age-equivalents computed from age at maximum growth with few exceptions did not produce markedly different results than those

based on the general age-equivalents.

The analysis of the data of the Harvard Growth Study is found to confirm and extend the applications of generalizations growing out of the growth studies in the laboratory school of the University of Michigan.

## ECOLOGY AND LAND-USE RELATIONSHIPS OF SMALL MAMMALS ON A MICHIGAN FARM

(Publication No. 1228)\*

Joseph Paul Linduska, Ph.D. Michigan State College, 1949

In most agricultural areas small mammals rank first in numbers among the vertebrates. As key organisms in the wildlife complex their position is axiomatic and some species are of direct economic importance. In spite of their over-all significance, few studies have been directed at the ecology of the group in farmland.

A growing appreciation of the general need for conservation is effecting a revolution in land-use practices and philosophies. New farming methods have demonstrated values that assure their wide-spread adoption, and the result will be major ecological changes for millions of acres. To evaluate the wildlife implications of these adjustments, and to utilize new agricultural techniques efficiently, will require intensive investigations on the ecology of animal populations. This small mammal study represents an effort in that direction.

Studies were carried out at the Rose Lake Wildlife Experiment Station, Clinton County, Michigan. Owned by the Michigan Department of Conservation, and operated for research on the wildlife of agricultural lands, the station comprises over 2000 acres of second- and third-class farmland.

Investigations, from September 1940 to December 1942, and March to August 1946, were conducted in cropfields and other herbaceous habitats and in the woodlots which made up 12 per cent of the total land area. Particular attention was given to determining,

- (1) comparative population levels of associated small mammals,
- (2) their response to various land-use and farming practices, and

(3) relationships within the group and with other wildlife.

Live-trapping was the principal method used. Trapping effort on small mammals amounted to 21,539 trap-nights, and 1843 individuals were taken by this or other means. Information on predators and other larger mammals resulted from 34,032 box-trap days in field situations, and intensive observation established comparative numbers of predatory birds. In woodlots, 748 non-game sciurids were trapped 2,176 times in 29,748 box-trap days.

<sup>\*</sup> Microfilm copy of complete manuscript of 273 pages, \$3.42. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-28.

The prairie deermouse (Peromyscus maniculatus bairdii) was the commonest field inhabitant during most of the year, and the house mouse (Mus musculus) an important secondary species. Both had similar requirements for ground cover which appeared to regulate their numbers and distribution. Grain crops were preferred to idle-ground habitats and both species avoided sod acres and wooded field margins. The diversity of cover types provided by strip-cropping had no discernible effect on prairie deermice. Similarly they showed no response to "edge" in block fields and were randomly distributed. Cultivation and harvest had no significant effect on deermice, but house mice abandoned fields following removal of crops. There was some eivdence of intolerance between the two species.

Locally meadow volves exhibited unorthodox seasonal trends in population. From extreme summer "lows," they increased rapidly in late autumn and reached annual population peaks in midwinter. Winter breeding was general and they were the commonest small mammal in much cropland during this season. A consistent association, and other evidences, suggested a close relationship between this species and the short-tailed shrew (Blarina brevicauda).

In seven woodlots totaling 102 acres, the fox squirrel (Sciurus niger rufiventer) increased in numbers from 1940 to 1942. Other sciurids decreased. With reference to type and grazing of woodlots, fox squirrels were commonest in grazed, upland oak-hickory units; red squirrels (Tamiasciurus hudsonicus) preferred lowland elm-maple; chipmunks were taken most commonly in ungrazed uplands; and flying squirrels (Glaucomys v. volans) showed some preference for moderately grazed upland woodlots. White-footed mice (Peromyscus leucopus noveboracensis), the most abundant mammal in woodlots, were commonest in lowland types and preferred the ungrazed condition in uplands.

### THE ECONOMIC DEVELOPMENT OF ST. LOUIS, 1803 - 1846

(Publication No. 1283)\*

Halvor Gordon Melom, Ph.D. University of Missouri, 1947

St. Louis, founded in 1764, remained a lonely trading post of the Spanish Empire during the 18th century. The years encompassed by this study are arbitrary, but in a very real sense the period represents the time during which a pioneering American outpost became a metropolitan city serving the needs of a rapidly expanding hinterland.

Perhaps the steamboat was the most important single factor influencing the city's rise to prominence in an age of water transportation. The market area the city served was at first limited to the simple needs of the immediate locality. St. Louis, however, because of its fortunate geographical position, expanded with the growing West, receiving the lead, furs, and myriad agricultural surpluses of the Northwest and distributing the manufactured goods of the East and the groceries of the South along the riverways of the Missouri and Upper Mississippi.

As the city grew during successive waves of immigration, its merchants and men of commerce strove to compete with the East and the towns of the Ohio for the trade of the surrounding country. The local provisions market, retailing the foodstuffs of Illinois and Missouri, expanded to supply the city's citizens. A barter economy gave way to a complex system of exchange dominated by the fact that an adverse balance of trade continually drained away the circulating medium to pay bills to the eastward. Two local banks, the Bank of St. Louis and the Bank of Missouri, failed before the early 'twenties and a hostile democratic back country in Missouri successfully denied the city's capitalists' demands for state or local banking facilities before 1837.

In the meantime branch banks which had filled the void were outlawed, and makeshift institutions — Insurance Companies combined with private capital and brokers — financed the building of the city, underwrote its commerce, and gave it an enviable reputation for soundness in recurring crises.

<sup>\*</sup> Microfilm copy of complete manuscript of 431 pages, \$5.39. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-83.

The prairie deermouse (Peromyscus maniculatus bairdii) was the commonest field inhabitant during most of the year, and the house mouse (Mus musculus) an important secondary species. Both had similar requirements for ground cover which appeared to regulate their numbers and distribution. Grain crops were preferred to idle-ground habitats and both species avoided sod acres and wooded field margins. The diversity of cover types provided by strip-cropping had no discernible effect on prairie deermice. Similarly they showed no response to "edge" in block fields and were randomly distributed. Cultivation and harvest had no significant effect on deermice, but house mice abandoned fields following removal of crops. There was some eivdence of intolerance between the two species.

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Industrial development waited upon commercial success and as a result most industries by 1840 were still in the shop stage of production, simply supplying local needs. Early development centered around the building trades, brewing, iron foundries, and tanneries which led a long list of lesser concerns. After that time and before the Mexican War the giants of a later era, such as flour milling and meat packing, were rapidly changing the industrial picture and foreshadowing the end of pioneering efforts.

Labor troubles, characterized by unionization, aggressive strikes, and class warfare, appeared in the middle 'thirties. Before that time labor, especially in the skilled trades, had been generally scarce and unorganized. The journeymen tailors' strike in 1835 was the first recorded in the annals of the city. Sporadic efforts were made among the various skilled trades to raise wages and to gain social recognition and greater civil rights. By 1840 the ten hour day had been generally won, and labor unsuccessfully entered the political arena to further its ends. At the end of the period under study boom times mitigated the conditions which had given rise to many of these troubles.

These years were formative, germinal years in almost every area of the city's economic life. By 1846 St. Louis had outstripped the Ohio towns and was second only to New Orleans on the riverways. The golden age of the steamboat — the Mormons, the Oregon pioneers, the men seeking gold in California, and the homeseekers who flooded the West that was tributary to St. Louis — heralded a new economic order.

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#### **ECONOMICS**

#### CHANGES IN THE DISTRIBUTION OF INCOME BY STATES, 1840 - 1938

(Publication No. 1232)\*

Donald S. Murray, Ph.D. University of Pennsylvania, 1944

This study comprises an economic and statistical analysis of differences and changes in the apportionment of national income payments, both in the aggregate and per capita, among the states and the District of Columbia from 1840 to 1938.

The study begins with a consideration of state or regional income analyses made prior to the Civil War, after which reasons for the lack of such studies for a long period following this conflict are noted. This survey of state and regional income analysis is completed with a consideration of those of the twentieth century. After this examination of the field, it becomes apparent that there are three sets of state income data available for analysis: The 1840 estimates of Ezra Seaman, the W.I. King-Maurice Leven data covering the years from 1919 to 1921, and the 1929-1938 figures of the Department of Commerce. No figures were found for the years from 1841 to 1918 and adequate data are lacking from 1922 to 1928 inclusive.

Using data of these years the investigation involves three major phases: First, the determination of the nature and magnitude of the secular movements, both the long movements from 1840 to 1929 and the shorter, inter-war movements from 1919 to 1938; second, the determination of the nature and magnitude of the cyclical variations; and, third, an analysis of these changes in relation to changes in other economic factors likely to have a direct bearing on the apportionment of the national income among the states.

Conclusions are necessarily tentative and subject to further verification as new data become available, but the following more important inferences appear to be valid. First, differences in income payments among the states show definite secular and cyclical changes. Second, income changes are closely and directly associated with population changes. Third, inequalities in the distribution of income have increased. Fourth, a state's share of national income varies inversely with the degree of its dependence on agriculture and directly with its dependence on manufacturing. Fifth, for the period 1929-1938, the income of agricultural states showed greater cyclical variability than the income of more highly industrialized states.

<sup>\*</sup> Microfilm copy of complete manuscript of 160 pages, \$2.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-32.

# THE DEVELOPMENT OF PUBLIC EDUCATION IN GRAND RAPIDS (1826 - 1906)

(Publication No. 1234)\*

Forrest Glenn Averill, Ed. D. University of Michigan, 1949

This is a study of the growth and development of the public schools of Grand Rapids, Michigan, during the first 80 years of the city's history and was undertaken for a dual purpose: first, so that a history of the Grand Rapids Public Schools would be written before the already very incomplete early records were lost or destroyed, and, second, so that the educational progress of those years might be studied as a means of helping to interpret present-day educational programs.

Since the problem is largely one of historical interpretation, the organization is primarily chronological. The various chapters consist of intensive studies of definite chronological periods, each being characterized by a phase of the growth of the school system. Within each chapter the events of the period were studied in relation to certain significant factors in educational development, such as: legal structure, life in Grand Rapids, administration, teacher welfare, and school buildings, to list a few.

Because of the nature of the problem and the great number of factors in community life which affect the direction and extent of development of the educational program in any given locality, the results of such a study cannot be definite or conclusive. In spite of this inability to show definite cause and effect relationships, it should help the citizens and school officials in Grand Rapids to understand better why their program developed as it did. It also has value as general educational literature because tracing the development of a specific educational program helps to understand others.

The following conclusions seem justified on the basis of the facts presented in the study:

1. The early residents had a strong interest in good schools.

<sup>\*</sup> Microfilm copy of complete manuscript of 370 pages, \$4.63. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-34.

- 2. Private schools did not play an important part in the total educational program.
- 3. During the early and formative years, District No. I (the largest and most influential) had an unusually strong board of education.
- 4. Strong support was given to public education by the newspapers.
- 5. The public schools were fortunate to have had good and in some cases exceptionally capable administrators.
- 6. The extensive collections of the Kent Scientific Institute were a great stimulus to the study of science.
- 7. The schools were always relatively free from disciplinary troubles.
  - 8. The teaching of reading and art was outstanding.
- 9. The close relationship existing for many years between the public library and the schools was of great benefit.
- 10. Grand Rapids was slow in abolishing tuition for resident pupils in the high school.
- 11. A teachers' salary schedule was adopted quite early and salaries were relatively good.
- 12. Although there were conspicuous exceptions, school housing was quite adequate.
  - 13. There were no serious problems of finance.
- 14. Grand Rapids was a pioneer in establishing school savings and summer playground programs.
- 15. The schools were strongly academic in nature and the socalled "practical subjects" were slow in winning acceptance.

#### FINANCING RURAL EDUCATION IN MISSOURI

(Publication No. 1273)\*

Royal Jay Briggs, Ph. D. University of Missouri, 1949

Purpose of the Study

The purpose of this inquiry is to learn the circumstances which cause educational opportunities for rural children to be of lesser character than those available to urban children; to determine if administrative and financing weaknesses exist; to ascertain the problems of financing a good program which will also provide for an equitable tax burden on property; and finally, to make suggestions for improving school opportunities for farm young people.

#### Method of Research

Information was secured from the statutes and official records of the State, and other pertinent materials and studies. For purposes of analysis, some figures from the official records were treated statistically.

Summary

The belief in public education has grown until today it is regarded as a right of every child regardless of race, creed, color, location, or economic circumstances. It is thought that the State should provide assistance which added to the receipts from a reasonable tax burden on local resources would enable a minimum school program to be offered.

Enough money appears to be available to support a minimum program in all districts if it is distributed on a basis which would stimulate the improvement of the school program.

The advent of automobile transportation and the decline in number of rural children through migration to urban areas should have caused a reduction in the number of school districts, especially in those areas where roads were well developed. The state aid plan tended to offset the incentives to consolidate and as a result little change occurred in the rural school district structure.

School needs and costs have been increasing. Many of the smaller districts have found it increasingly difficult to raise by

<sup>\*</sup> Microfilm copy of complete manuscript of 267 pages, \$3.34. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-73.

reasonable taxation enough money to support a school. Some school districts of greater wealth were able to provide adequate school services with a low levy on property.

The proportion of rural schools meeting minimum standards for approval while never large, tended to decrease at the very time that average cash balances for school purposes were increasing.

Considerable reliance is placed upon receipts from local taxation to support schools because: (1) state aid while increasing has not been sufficient to finance the school program: and (2) school costs have been advancing since 1940.

The effort being made to support education cannot be determined solely from the tax rate levied. It is also necessary to consider the size of the tax base, the taxing procedure, the expected rate of delinquency, and the relationship of the tax amount to the income level of the taxpayer.

An analysis of eighty-six of the 114 counties in Missouri showed that most of the low-valued counties were making a greater effort to support education than many of the high-valued ones.

The new bipartisan State Board of Education is, no doubt, giving serious consideration to suggested changes in the rural school area. Any rural school adjustment program to be effective will have to recognize: (1) the nature and physical structure of farming; (2) the dwindling rural population; and (3) the continuance of a country-to-city migration from areas where not all children will be needed for adult replacement.

#### Recommendations

- 1. Minimum goals and standards might well be established as a condition precedent to receiving state aid.
- 2. School districts with more adequate tax resources should be encouraged to use them to provide a better school program than the minimum standards suggest.
- 3. A state school system should exercise some control over all administrative officials associated with the operation of the public elementary and secondary schools.
- 4. It is highly desirable to retain local control of administration wherever it is successful in achieving a modern school program.
- 5. The one-room school should be retained wherever the program offered is substantially as effective and economical as the next most feasible opportunity.
- 6. Through improved property assessment, it should be possible to help somewhat in equalizing the tax burden on property.

- 7. The equalization amount should be capable of financing the prescribed minimum program.
- 8. If a prescribed minimum program is established, the first distribution of state aid should be for the purpose of permitting all school districts to offer the minimum program.
- 9. Balances carried over by a district "for school purposes" should be treated as deductions in determining the amount of state aid due.
  - 10. The granting of special aids should be reviewed frequently.
- -11. If sufficient state aid is being granted to offer the minimum program, the school should be required to offer an approved program.
- 12. Parents should be represented on the board of the school district providing instruction to their children.
- 13. Frequent audits of school district records should be provided for by law.
- 14. The State Department of Education might have a special section to aid in the reorganization of school districts.
- 15. A liaison agent is needed to secure the best possible cooperation between highway departments and school districts.

#### THE EDUCATION OF THE NEGRO IN MISSOURI

(Publication No. 1274)\*

Robert Irving Brigham, Ph. D. University of Missouri, 1946

In the light of increasing attention paid to the problem of the Negro in America and of the Negro's recent struggles for educational opportunities, the story of Negro education in Missouri deserves attention. A border state with a Negro population of less than ten per cent Missouri, while not typical of the states practicing segregation in public schools, offers a proving ground for Negro advances toward equality of opportunity in education.

<sup>\*</sup> Microfilm copy of complete manuscript of 285 pages, \$3.57. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-74.

This study, then, is an historical analysis of the development of the schools for Negroes in Missouri, public and private, elementary, secondary, and higher. Having made a brief but thorough examination of the historical development and status of Negro education in the United States generally, against which the conditions of such education within Missouri can better be evaluated, this study attempts to ascertain the conditions of Negro education in Missouri.

Chapter III shows the characteristics of the institution of slavery in the state and points out its differences from the slavery which existed in the South. The three chapters following picture the growth of elementary and secondary schools for Negroes from the days of 'carpet bagging' enthusiasm for Negro education, through the period of reaction against such privileges for Negroes, through the long years of neglect and slow growth, and through the relative resurgence of interest in Negro schools which came on in the last quarter century.

Chapter VII is devoted to the story of the church-affiliated colleges from their founding to the present. An analysis of their growth, facilities, and potentialities is presented.

The state university for Negroes is treated in three chapters showing her early years, her subsidization by the state, her gradual rise to college status, her purge of politics, and her recent attempt to become a university. Similarly the teachers' college and junior college education for Negroes offered within the state is analyzed. And, though such provisions are recent, attention is given the graduate and professional education now offered Missouri Negroes.

Conclusions to be reached on the basis of this study are definite and unavoidable. Elementary and secondary education, growing together with the education for whites, which did not become firmly established in the state until after the Civil War, shares many of the gains of the white schools. The Negro schools, though, suffered first from lack of trained teachers, then from lack of attention. More recently the rural schools have suffered while the urban schools, both for Negroes and whites, grew stronger. Where a scattered Negro population makes Negro schools well nigh impossible, segregation continues to leave hundreds of Negroes without schools.

The churches and philanthropic agencies are found to have overlooked Missouri in their generosity toward the Negro, perhaps because the Negro in Missouri represented so small a proportion of the population. The two church-related colleges for Negroes in Missouri lived meagre existences as boarding high schools of low rank. Today one of them still exists, much as it did fifty years ago.

Lincoln University, starting as a starved private institution, happily received aid when the state discovered it had to train teachers for its Negro schools. Gradually the institution grew stronger, gaining sectional accreditation in 1936. It was only with the removal of the influence of the politics from her administration that Lincoln could become a college in truth, and then the force of circumstances demanded that she attempt to become a university.

Graduate instruction for Negroes in Missouri is still minimal, the majority of Negroes going out of the state for such education. Likewise, except for journalism and law, both taught within the state through expensive 'equal' schools, Negroes must leave Missouri for professional training.

The entire situation is a difficult one, apparently demanding coracial education in regions of sparse Negro population and on highly specialized levels. The action of St. Louis University in allowing Negroes to attend along with the whites may point toward the ultimate solution, but it is more likely, in view of the long history of segregated education in the state, that the present arrangement will be maintained for some time.

## THE RELATIVE EFFECTIVENESS OF TWO METHODS OF TEACHING SOCIAL SCIENCE AT THE COLLEGE LEVEL

(Publication No. 1242)\*

Arthur Richard DeLong, Ph. D. University of Michigan, 1949

The problem of this study is to determine the relative effectiveness of two methods of teaching social science at the college level. The first procedure, Method A, may be characterized as a logical or traditional method in which the subject-matter is presented in terms of the student's future adult needs. The second procedure, Method B, may be characterized as a psychological or a progressive method, the subject-matter being presented in terms of the student's immediate interests and abilities.

Four sections of essentially equated social science classes were used in this study. Each of the two teachers who participated in the study taught one Method A and one Method B section.

<sup>\*</sup> Microfilm copy of complete manuscript of 162 pages, \$2.03. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-42.

Five measuring instruments were selected or devised to measure the outcomes of each of the two methods. These instruments were selected because it was felt that they would measure the five following objectives:

- (1) Scale of Beliefs

  To assist the student to develop constructive social attitudes.
- (2) Subject Preference To stimulate the individual to develop an interest in social science.
- (3) Observers' reports of questions and comments within the social science class-room.
- (4) Subject-matter examination

  To assist the prospective teacher to acquire a sufficiently adequate command of the subject-matter so as to insure a broader background than his subject field alone would give him.
- (5) Course Rating Scale To present the material in terms of the students' interests and abilities.

The data were analyzed using techniques for analysis of variance and covariance and for determining the reliability of differences between percentages.

Among the significant findings obtained were the following:
The first objective was achieved to a greater degree through
the use of Method B than it was through the use of Method A. There
were, however, factors which appeared to be outstanding in influencing the magnitude of the superiority of Method B.

The second objective was achieved by both Method A and Method B. There was no significant difference between the gain in interest in social science between the students in the two sections.

Method B is significantly superior to Method A in the achievement of the third objective. Not only do a greater percentage of Method B students participate in the class discussions than do Method A students, but each student makes more contributions and asks more questions. The latter difference may be indicative of a greater interest in social science.

Method apparently is not a significant factor in the achievement of the fourth and fifth objectives. However, when taught by a teacher who prefers Method B to Method A, Method B is superior in the achievement of the fourth objective.

The findings of this investigation revealed that for the achievement of certain objectives, Method B was shown to be significantly superior to Method A. For the achievement of other objectives, Method B appeared significantly superior to Method A only when used by a specific teacher whereas when used by another teacher the two methods were comparable. There were no instances in which Method A was found to be significantly superior to Method B. It may therefore be concluded that Method B is clearly superior to Method A for the achievement of certain objectives, though it appears to be true that this superiority is greater in the hands of some teachers than in others. In fact, it may be true that for some teachers, the superiority of Method B over Method A would not be evident. This investigation indicates that whenever, for individual teachers, there is a significant difference favoring one method or the other, the difference favors Method B.

#### AN EXAMINATION AND ANALYSIS OF CORE PROGRAMS IN CERTAIN MICHIGAN SECONDARY SCHOOLS FROM 1937 TO 1947

(Publication No. 1212)\*

Roland Cleo Faunce, Ph. D. Michigan State College, 1947

The Problem

The term "core program" has been defined for the purposes of the present study as a program in which a block of two or more periods is utilized for general education, either fusing two subject areas or employing a problem-approach without any subject limitations. The study was undertaken because of the current interest in the core curriculum in secondary schools and the efforts to evaluate core programs in Michigan high schools. The schools selected for such study were the Big Rapids, Bloomfield Hills, Dowagiac, and Wayne High Schools, the Edwin Denby High School in Detroit, Godwin Heights High School in Grand Rapids, Highland Park Junior High School, and Lakeview Junior High School in Battle Creek.

Evaluation was made in strict harmony with the locally-determined goals of the programs. The data were derived from the files of the Secondary Study and the Department of Public Instruction, information resulting from consultant contacts in the schools, administration of an interview schedule in seven of the schools and of a mailed opinionaire to former teachers of the eighth school, and the outcomes of certain local research studies.

<sup>\*</sup> Microfilm copy of complete manuscript of 305 pages, \$3.82. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-13.

#### Survey of Related Practice

In Chapters II and III of the dissertation, a review is presented of the related practices throughout the United States, and in Michigan. The trends on which these related core programs were based were as follows:

- (1) The organismic psychology
- (2) The guidance movement
- (3) The civic education trend
- (4) The trend towards learning aids
- (5) The community school concept

#### Purposes of the Core Program

Analysis of the basic purposes of the eight programs reveals an emphasis upon more effective guidance, synthesis of learning experiences, flexibility, practical application of theory, democratic processes, and the growth of teachers.

#### Initiation of Programs

These eight programs appear to have been largely initiated through local leadership of principals and teachers, which was nurtured by the democratic philosophy and unusually generous provisions for planning time and challenges to service.

#### Instructional Procedures in Core Programs

These programs did not derive their source from data on child growth and development, but contributed to that emphasis as they developed. They reflected a strong influence from the trend of the times. Learning experiences were also derived from teacher-pupil planning, from books, and from adult assumptions. The trend was toward multiple reading and visual materials, with a minimum of emphasis upon drill activities. The ideal appears to have been a group attack upon current social or economic problems, selected by teacher-pupil planning, and with considerable use of small group and individual research.

#### Effectiveness of Programs

The somewhat limited evaluative data indicate that these core programs were relatively effective. Pupils appear to have held their own in respect to conventional goals of instruction while making important gains in personal-social adjustment and citizenship. They tended to like school better, remain in school longer, and understand better their own growth. Teachers and administrators considered the programs successful in their effects upon children and teachers, and a salutary influence upon the total school.

The programs were weak in social interpretation and in provisions for evaluation.

Implications

The final chapter lists several implications of the study and analyzes the reasons for success or failure of these eight unified programs.

A CONTEMPORARY EDUCATIONAL AND SOCIAL SOURCE BOOK ON PROBLEMS OF ALCOHOL AND PROBLEM DRINKING IN UNITED STATES FOR USE OF TEACHERS, SCHOOL ADMINISTRATORS AND COMMUNITY LEADERS

(Publication No. 1216)\*

Joseph Hirsch, Ed. D. New York University, 1949

The results of a survey of State Departments of Education, to determine the legal requirements, the content and practices in alcohol education, reveal: (1) that biases in statute statements on alcohol education are reflected in teaching practices; (2) that the content of alcohol education, as revealed in textbooks, teaching manuals, resource units and other publications are frequently inadequate, inaccurate and biased; (3) that teaching practices reflect not only biases in the law but also pressures placed upon teachers and school boards by vested interest lay groups.

The greatest gap in instruction on the problems of alcohol is in the area of social responsibility and medical care of the problem drinker and in the relationship of alcohol with crime, illness, delinquency and divorce. The reasons for lack of instruction in these areas are based in part upon the lack of recognition of the complexity of the problems of alcohol; in part upon the failure to recognize the problem drinker as a sick person both, with and without, respect to alcohol; in part upon the traditional emotionalism and morality which have pervaded these problems. The historical background to current social attitudes towards drinking alcoholic beverages is highlighted.

Source materials based upon the most current and accepted scientific documents on the problems of alcohol are developed. These include materials on the chemistry and physiology of alcohol, the so-called alcoholic diseases such as polyneuropathy, beri-beri, pellagra and various mental diseases which are primarily vitamin deficiency diseases. The problem drinker, distinguished from the acute intoxicant, is presented as a medical and social problem. His potentialities

<sup>\*</sup> Microfilm copy of complete manuscript of 327 pages, \$4.09. Enlargements 6" x 8" 10¢ per page. Library of Congress Card Number Mic A 49-17.

of rehabilitation through constructive medical and social programs are outlined.

Source materials describe the character and extent of social drinking in the United States in terms of time periods, age, sex, nationality, religious, economic, educational and other factors. Problem drinking or chronic alcoholism is similarly described.

Based upon available source materials, evaluation is made of the relationship of alcohol with problems in personal and social disorganization such as traffic accidents, crime, delinquency and divorce, promiscuity and other factors. This evaluation reveals the need to interpret with extreme caution the data available on these relationships.

The constructive research, medical, social and educational action undertaken by organizations such as Alcoholics Anonymous, The Research Council on Problems of Alcohol, the Yale Plan of Alcohol Studies and the National Committee for Education on Alcohol are reported. Evaluation is made also of traditional as well as more recent constructive medical, social and educational programs undertaken by government in behalf of the problem drinker and on the problems of alcohol. A guide for future social action, based upon the historical pattern and the more recent constructive practices, is suggested.

In conclusion, an outline is presented of some of the fundamental gaps in scientific knowledge concerning the problems of alcohol and the problem drinker and of the need, therefore, for education to approach with caution and balance instruction on these problems in which many unknowns and areas of doubt exist.

### THE DEVELOPMENT OF GRADUATE INSTRUCTION IN THE UPPER MISSISSIPPI VALLEY AREA

(Publication No. 1278)\*

Glenister Clarence Hoskins, Ph. D. University of Missouri, 1949

This investigation traced the nineteenth century beginnings and the twentieth century development of graduate instruction at the doctoral level in ten state universities located in the upper Mississippi Valley area. Using the historical method and employing documentary evidence from primary sources, the following aspects of graduate instruction in the selected institutions were examined: (1) factors

<sup>\*</sup> Microfilm copy of complete manuscript of 386 pages, \$4.83. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-78.

contributing to the development of graduate instruction before 1900; (2) the stated aims of graduate instruction from 1900 to 1945; (3) catalog stated practices bearing on doctoral level instruction during the period from 1900 to 1945; (4) instructional factors influencing the effectiveness of doctoral level instruction; and (5) trends with respect to areas of specialization at the doctoral level during the period from 1900 to 1945.

Among the ten institutions before 1900, doctoral level instruction developed slowly, few earned doctorates being conferred from 1876 to 1900. Upon foundations established by the liberal arts tradition, doctoral level instruction attempted to blend the doctrine of mental discipline, German ideals of scholarship and research, and the emphases represented by the Morrill Act of 1862 and the Hatch act of 1887. Until after 1900, graduate instruction was dominated by the division of the arts and sciences. Only two institutions established separately administered graduate divisions before 1900.

The legally defined aims of the ten institutions emphasized knowledge having a relevance to the social, political and economic order. Graduate school aims emphasized the pursuit of science for its own sake. The latter aim reflected a spirit of individualism and contributed to a growing compartmentalization of knowledge. The leadership and spokesmen for the ten graduate schools made no concerted efforts to restate aims of graduate instruction during the period from 1900 to 1945.

Stated practices with reference to doctoral level instruction in the ten institutions reflected the research aspect of the doctor's degree and colored such requirements as admission, length of residence, courses, languages, examinations, and thesis. Changes made during the period from 1900 to 1945 reflected quantitative rather than qualitative aspects of requirements. Assembly line standards of proficiency tended to compromise earlier undefined university ideals.

The ten graduate schools provided programs which encouraged the development of only selected departments. This policy, coupled with the departmental organization of faculties, tended to narrow the influence of the graduate schools to a form of nationalism among competing departments. Teaching as a function received less emphasis than the research function.

Of the 14,149 doctorates conferred by the ten institutions during the period from 1900 to 1945, more than half were conferred during the last eleven years of the period. From 1920 to 1940, the ten institutions conferred annually more than one-fifth of all doctorates in the United States. During the latter period the number of graduate students increased out of all proportion to the increase in number of full professors. Seminar techniques, as originally conceived, were abandoned in favor of lecture methods, graduate courses multiplied in num-

ber and graduate school administrators began seeking means by which student enrollments might be limited.

The waning influence of liberal arts courses was paralleled by the rise of science, particularly chemistry. The growing differentiation of knowledge as represented by areas of specialization indicated that the ten graduate schools contributed to an increase rather than a decrease in the "spirit" of independence and isolation. The employment status of recipients of the doctorate during the period from 1930-31 to 1939-40 indicated that two-thirds were not primarily engaged in research, the activity toward which graduate aims and methods were chiefly directed.

#### A DETERMINATION OF MATERIALS DEALING WITH SOIL CONSERVATION AND SUITABLE FOR INTEGRATION INTO COURSES OF HIGH SCHOOL SCIENCE FOR GENERAL EDUCATION

(Publication No. 1248)\*

Edward Eugene Irish, Ph. D. University of Michigan, 1949

The purpose of this investigation was to select and organize, from periodical literature, materials of soil conservation suitable for integration into courses of high school science for general education.

A tentative outline of the various aspects of soil conservation was developed which served as criteria in locating and identifying materials in periodical literature.

The validity of the outline was established by submitting it to three authorities with instructions that they make any deletions, amendments, or suggestions.

It was found that the outline, as constructed by the investigator and validated by the three experts in conservation, was adequate for selecting and identifying materials of soil conservation.

The periodicals used consisted of a month's issues of four newspapers and a year's issues of three magazines. All materials in the periodicals were examined with the exception of (1) advertisements, (2) letters of opinion to the editors, and (3) those which appeared to be fiction. Any statement, passage, etc., which dealt with one or

<sup>\*</sup> Microfilm copy of complete manuscript of 131 pages, \$1.64. Enlargements, 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-48.

more points of the outline was designated as a "knowledge" of conservation education. The knowledges thus obtained were combined into mutually exclusive aspects of soil conservation. The 49 aspects thus determined were evaluated by five specialists with respect to their suitability for integration into courses of high school science. Every aspect which received a composite positive value was assigned by the investigator to one of the principles of physical or biological science or to one of the five major scientific attitudes. In every case it was found that such an assignment was possible on the basis that the materials of the aspect could be made to contribute to the understanding of a principle or to assist in the development of an attitude.

The defensibility was checked by having two of the specialists in the teaching of science examine all the investigator's assignments of the aspects to the principles or attitudes. In every case the assignment was approved by both specialists.

Thirty-three of the forty-nine aspects were judged to be of value for inclusion in courses of high school science for general education.

Each of these aspects was assigned to either a principle or an attitude. Seven were assigned to three principles of physical science; nineteen were assigned to six principles of biological science; and seven were assigned to two scientific attitudes.

The outline developed in this investigation appears to possess a validity sufficiently high to justify its use in investigations of periodical materials dealing with conservation.

Periodical literature, of the nature used in this investigation, contains much material dealing with soil conservation.

Many of the materials dealing with soil conservation, as presented in the periodical literature, have positive values for integration into courses of high school science for general education.

Each of the aspects of soil conservation contains materials which may be employed

- (1) to contribute to the understanding of principles of physical and biological science;
  - (2) to assist in the development of scientific attitudes.

The aspects are valuable as sources of materials for courses in conservation at the secondary level.

#### AN AUTOMOTIVE CURRICULUM FOR THE STATE OF OHIO

(Publication No. 1218)\*

Henry Robert Kinker, Ed. D. New York University, 1949

The problem which forms the basis of this study is the construction of a trade preparatory automotive curriculum that may be used as a criterion in evaluating the existing curricula in the State of Ohio. Beginners in the trade, no matter where they receive their training, require essentially identical instruction and practice. But except in a few isolated cases, there has been no concerted effort to develop the desired uniformity in curriculum content.

Heretofore the responsibility for curriculum construction has tacitly been delegated to trade and industrial instructors at the local level. While some creditable curricula have occasionally resulted, the obvious diversity in content has been a cause of concern to those persons who are responsible for the administration of the total program throughout the State. In some instances the lack of any tangible material has further added to the concern regarding the quality and extent of the instruction.

This study was devised to alleviate some of the more urgent needs in trade preparatory automotive training, and was undertaken with the co-operation of all members of the Trade and Industrial Education staff and a majority of the automotive instructors. At the outset a trade analysis approach was selected as the most feasible procedure. In this connection trade analyses and courses of study were collected from outstanding schools both within and outside of the State of Ohio, and from the Departments of Vocational Education in the forty-eight states, the District of Columbia, and the territories of Hawaii and Puerto Rico.

From this material and the data contained in commercial as well as manufacturers' flat rate and service manuals, a tentative check list of manipulative jobs was developed. This list was sent to automotive instructors throughout the State and with the assistance of their local advisory committees they evaluated the content according to a previously established set of criteria. When the lists were returned by the various instructors a master list of manipulative jobs was compiled. This master list was used in determining

<sup>\*</sup> Microfilm copy of complete manuscript of 363 pages, \$4.54. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-19.

the basic trade technology material required for the understanding and intelligent performance of each of the manipulative jobs. Instructors were again called upon to evaluate this material.

After validation of the data they were used in constructing a special type of trade analysis which actually is a two-course curriculum. It may be used, without further preparation, in teaching the 142 manipulative lessons and a similar number of trade technology which resulted from the study.

One of the results of the study was the discovery that a lack of uniformity in curriculum content is not confined to any one section of the country. More than that, much of the material in current use is only partially complete and is lacking in the specificity which would make its use more effective.

The curriculum developed in this study is designed to fulfill the needs of youth who desire the basic training which will permit them to enter the automotive trade with the status of advanced learners.

It is recommended that the instructors who use this material follow a logical sequence of instruction, and that the shop and trade technology instructors consult one another frequently in order to effect a close correlation of their instruction. For instructors who prefer to continue using material which they have already developed, it is suggested that they compare their material with that contained in this curriculum and revise their offerings in the light of indicated needs.

## A COLOR MOTION PICTURE WITH MANUAL FOR USE IN PHYSIOGRAPHY CLASSES IN THE SENIOR HIGH SCHOOL ON THE SUBJECT GEYSERS AND GEYSER ACTION

(Publication No. 1221)\*

Harold Emory Richardson, Ed. D. New York University, 1949

#### The Problem

The problem was to produce a silent color motion picture with manual for use in Physiography classes in the Senior High School on the subject, "Geysers and Geyser Action."

#### The Method

The investigator made an analysis of high school physiography textbooks used in New York State to discover how the

<sup>\*</sup> Microfilm copy of complete manuscript of 115 pages, \$1.44. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A49-21.

principles of geyser action were taught. A study of geysers and geyser action as explained in books, periodicals, government bulletins, journals of geology was then attempted. A study was also made of the principles for production and use of motion pictures that visual education authorities consider essential. The motion picture was then produced in accordance with the facts found in these studies.

#### Objectives

High school textbook material and the treatment and explanation of the topic, "Geysers and Geyser Action," was found to be meager and incomplete. The purpose of the study was to produce a color motion picture which would clearly explain the principles of geyser formation and action both above and below ground. A motion picture was chosen as the medium for depicting geyser action because motion is best expressed by this medium rather than by still pictures. A colored motion picture was made in order to better create the illusion of reality by making a presentation of this unique subject in harmonious color patterns. The silent colored motion picture was produced in order to permit the teacher to use his own methods of presentation and vary the narration according to the needs and aptitudes of different classes.

#### The Content

Eight hundred feet of colored motion pictures were produced. More than one-half of this eight hundred feet was colored diagrammatic drawings and about one-third was colored animation. A fifty-two-page manual was written to accompany the film which may be used as an effective aid to the teaching of this topic.

The development of a hot spring into a geyser is indicated in diagrams as well as the action in the geyser itself. Twenty-two water color drawings were made and were verified as to geological accuracy by geologists. Many diagrams were modifications of previously used diagrams in standard textbooks. The diagrams were also presented for criticism and suggestions to ten Earth Science and Science instructors in high schools and to two professors of Natural Science in Departments of Education. A few diagrams of cross sectional areas of geyser regions were original. All diagrams were checked and approved by geological authorities.

An earth model was constructed and photographed. This model showed in a three dimensional quarter section the composition of the interior of the earth with its extremely weak aesthenospheric layer under a strong crust, the lithosphere. The approximate triaxiality of the geoid, with the considerable degree of strength in the thick layer, the mesophere, may be explained through the use of the model as well as the possible presence of an iron-nickel core, the

material underneath the strong mesopheric layer. Drawings and diagrams represent the composition, density and temperatures of the earth shells with their internal discontinuities. Also, a working model of a geyser in cross section depicts the action of geysers in color. Animation in color depicts: the possible lava flow in the region of Yellowstone National Park, the flow of underground water, the possible development of a hot spring into a geyser, the complete cycle of action in the periodic play of geysers. The model climaxes the animation photography with a working display of the eruption of an active geyser. The silent colored motion picture film ends with a series of geyser motion pictures at sunset.

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## THE DEVELOPMENT OF OUTCOME MEASURES FOR TEACHING PROCEDURES LEADING TO GROUP DISCUSSIONS

(Publication No. 1236)\*

Everett Warner Bovard, Jr., Ph. D. University of Michigan, 1949

The problem was to determine what variables are related to production of group cohesion in the classroom situation. Group cohesion is here defined as the ability of the group to maintain itself and to act as a unit.

The procedures believed to lead to cohesion were termed group-centered; they involved encouragement of interaction among students, group decisions, and the teacher in the role of a member of the group. Two experimental sections from the elementary psychology course at the University of Michigan, taught with these procedures in the Spring of 1948, showed evidences of cohesion at the end of the semester. Two sections of the same course, matched to the first two, were taught with teacher-centered methods, where interaction was kept channelled between teacher and student, no group decisions were permitted, and the teacher assumed the role of a leader. The course content was the same for both kinds of sections, and the two teachers involved (each with two matched sections) were instructed to be equally friendly in both sections. The two teacher-centered sections showed little if any evidences of cohesiveness at the end of the semester.

Several techniques, themselves separate from the teaching process, were devised to evaluate the two kinds of teaching procedures used. The work of Sherif with the auto-kinetic effect led to the design of the green rectangle, a perceptual measure for the teaching procedure used: the rectangle was used to measure the influence the group average had on the individual's estimate of rectangle size. From work in group therapy by Slavson and others in the last few years, it was felt likely that some emotional effects obtained in group therapy would likewise be manifested in the group-centered teaching situation. An affect scale was designed to measure the likes and dislikes of group members for each other. A situational test was arranged, consisting of a 15-minute group discussion following showing of the film "Feeling of Rejection." This

<sup>\*</sup> Microfilm copy of complete manuscript of 128 pages, \$1.60. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-36.

discussion was recorded on wire and analyzed for evidences of deeper emotional consequences of group-centered procedure.

The three instruments devised were administered toward the end of the semester.

Conclusions follow:

- 1. Group-centered teaching procedures lead to the development of group cohesion as it has been here defined.
- 2. Student-to-student interaction is a major factor in production of cohesion in the classroom situation. While it is a necessary condition for cohesion, there is no evidence that it is a sufficient condition for cohesion.
- 3. Estimates of length of a rectangle made by a group-centered class will change more in the direction of the group average, once that average has been announced, than will estimates of a teacher-centered class towards end of a semester.
- 4. Dispersion for initial estimates of length of rectangle will be greater in group-centered than teacher-centered sections at end of semester.
- 5. The average level of affect will be appreciably higher in group- than in teacher-centered sections at the end of semester.
- 6. Student-to-student interaction in the classroom situation apparently causes the affect level to rise.
- 7. Students in group-centered classes and teacher-centered classes will rate the group as a whole higher on the affect scale than they will the individuals in the group as an average. The disparity is significantly greater for the group-centered sections.
- 8. Dispersion of affect scale ratings of each other by students will be higher in group-centered than teacher-centered sections at end of semester.
- 9. Students in a group-centered class at end of semester are more sensitive to feelings, more capable of emotional identification with other persons and more capable of understanding personality problems than students in a teacher-centered class.

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## THE EMPIRICAL METHOD OF FREDERICK ROBERT TENNANT

(Publication No. 1214)\*

James Oliver Buswell, Ph. D. New York University, 1949

The problem which constitutes the subject matter of this thesis is an analysis of the empirical method of F. R. Tennant, a comparison of Tennant's empiricism with the empiricism of John Dewey, and an examination of the possible philosophical implications of Tennant's empiricism for those areas of American education in which Dewey's thought is a prevailing influence.

The method employed is inductive and topical. This method has been facilitated by the fact that, without injustice, the empiricism of each of the two philosophers may be subsumed under the three principal heads, psychology, epistemology, and ontology or metaphysics, and by the further discovery that the writings of each, relevant to the present investigation, may be roughly classified in these three divisions.

Tennant's empirical psychology is largely concentrated in the first half of Volume I of his Philosophical Theology and in the first third of his Philosophy of the Sciences. His epistemology is elaborated in the latter half of the former book and in the central portion of the latter; and his metaphysics in the second volume of his Philosophical Theology, and in the last third of his Philosophy of the Sciences. These three divisions of Tennant's subject matter have been presented in Chapters I, II and III.

Dewey's psychology, not as a whole, but such psychological views as may profitably be compared or contrasted with Tennant's philosophy of psychology, are found in several shorter works reviewed in Chapter IV. His epistemology is presented chiefly in his Quest for Certainty and in his Logic, reviewed in Chapter V. Dewey's metaphysics, the subject of Chapter VI, is adequately set forth in Experience and Nature, in portions of Art as Experience, and in A Common Faith.

The following conclusions are based upon the data of the topical inductive investigation above described. In the philosophy of empirical psychology, it is not the conclusion of this thesis that

<sup>\*</sup> Microfilm copy of complete manuscript of 598 pages, \$7.48. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-15.

Tennant has said the last word on the subject of the self, but it is suggested that Tennant has stated the problem in a fresh and stimulating manner, a manner which is likely to promote more valuable investigation. In empirical epistemology it is the conclusion of this thesis that Tennant's bi-polar view of phenomena, — regarding them as appearances of objects to subjects, — is more fruitful than Dewey's denial of this bi-polarity. In empirical metaphysics this thesis reaches the conclusion that data for any conceivable field of being cannot, consistently with empiricism, be ruled out on a priori grounds.

For further research, it is specifically recommended that (1) in the field of psychology empirical philosophy devote more careful attention to the question of personality or the self. Dewey's statement that this is "the problem of our day and generation" is accepted by the present writer as probably literally true. In terms of empirical philosophy and scientific psychology, (as yet,) as Dewey says, "the problem is unsolved". (2) In epistemology, the apparent bi-polarity of the knowledge process may profitably be investigated further. Grounds for the rejection of epistemological bi-polarity are not yet sufficient. Grounds for the confident acceptance thereof may prove capable of more convincing presentation than heretofore. (3) In metaphysics, this investigation has shown that empirical philosophy has great need of caution against a priori negatives. It is suggested that the place of the a priori in important writings in the field of empirical philosophical theology be subjected to thorough criticism.

# THE DETERMINATION OF THE RELATIONSHIP BETWEEN THE PERSONALITY TRAITS OF TEACHERS AND THEIR EVALUATION OF OBJECTIONABLE PUPIL BEHAVIOR

(Publication No. 1170)\*

Elmer J. Clark, Ph. D. University of Michigan, 1949

This investigation is an attempt to examine two hypotheses; namely, (1) that there is a significant relationship between the personality traits of teachers as measured by the Guilford-Martin Personality Inventories, and the teachers' evaluations of the degree of

<sup>\*</sup> Microfilm copy of complete manuscript of 167 pages, \$2.09. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-379.

annoyance they experience with selected pupil behaviors, and (2) that there is a significant relationship between the personality traits of teachers and certain personal data items.

Related literature was surveyed to obtain a list of objectionable pupil behavior items. Seventy-two elementary school teachers rated these items on two bases: annoyance and frequency of occurrence. Thirty-five items were thus secured and submitted to 181 elementary teachers for final evaluation of their annoyance value. The returns were then studied by means of the paired comparisons technique to determine the respective degrees of annoyance which each item had for the individual teachers concerned. The 181 teachers also completed a personal data inventory and the Guilford-Martin Personality Inventories.

The method of cumulative totals was employed for the computation of correlation coefficients and correlation ratios between each of the personality trait scores and each of the annoyance and personal data scores. Each coefficient of correlation was tested for significance against the null hypothesis, and the chi-square test of linearity of regression was applied in all cases. Epsilon was computed in those instances where non-linearity was discovered, in order that the significance of the correlation ratios might be determined.

Varying degrees of linear relationships were discovered between the annoyance scale values and the Guilford-Martin traits. No significant relationship was found in the case of eleven behavior items; a positive relationship was found for twelve behavior items, and negative relationships were discovered for twelve other items of pupil behavior. The first hypothesis was thus partially supported.

Varying degrees of relationships were found between the personal data items and the Guilford-Martin traits. Thus no significant relationship was found for nine personal data items, significant negative relationships were found for two personal data items, and significant positive relationships for the remaining five. The second hypothesis was thus partially supported.

In general, there was little evidence of non-linearity of regression between the Guilford-Martin traits and the annoyance scale values and personal data responses.

It has not been intended that all problems pertaining to pupilteacher relationships would be solved as a result of this study; however, it is hoped that first steps have been taken toward their solution, by identifying certain pupil behaviors which are annoying to teachers on the one hand, and relating them to personality factors of the teachers concerned on the other.

## THE RELATIONSHIP BETWEEN NUMERICAL-VERBAL ABILITY AND EDUCATIONAL AND VOCATIONAL INTERESTS

(Publication No. 1200)\*

William Frank Holmes, Ph. D. University of Michigan, 1949

This is a study of the relationship between ability type and educational and vocational interests. The term 'ability type' refers to the varying degrees of differential between numerical ability and verbal ability found within individuals. The measurements used are derived from intra-individual differences which are determined by comparing an individual's numerical ability with his verbal ability.

The chi square statistical technique is used to test this major null hypothesis: There is no significant relationship between numerical-verbal ability pattern and the educational and vocational interests of male, college preparatory, high school seniors. This general test of independence or lack of relationship between ability patterns and interests is contingent upon these specific null hypotheses which are tested in the course of this study: there is no significant relationship between the numerical-verbal ability pattern of high school seniors and:

- 1. the type of college major they contemplate.
- 2. the degree of definiteness they express in stating their educational plans.
  - 3. the high school studies they like best.
  - 4. the high school studies they like least.
- 5. the category of response they give to a question calling for a self-estimate of special ability or aptitude.
- 6. the category of response they give to a question calling for a self-estimate of special disability or lack of aptitude.
- 7. the category of response they give to a question calling for a statement of any difficulty encountered in high school.
- 8. the general opinion they hold concerning the overall difficulty of the college preparatory curriculum.
- 9. the "interest type" into which they fall on a standardized interest inventory.
- 10. the "interest differential" they show on a standardized interest inventory.

<sup>\*</sup> Microfilm copy of complete manuscript of 95 pages, \$1.19. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-1.

The results indicate that we may confidently reject the hypothesis that there is no relation between numerical-verbal ability patterns and these interest variables. We can reject the null hypothesis beyond the 1 percent confidence level for variables 1, 3, 4, 5, 7, and 8; between the 1 and 2 percent confidence levels for variables 2 and 6; between the 2 and 5 percent confidence levels for variable 9; and between the 5 and 10 percent confidence levels for variable 10.

The general conclusion is that a test of the ten minor hypotheses allows us to assume with a reasonable degree of confidence that there is some type of relationship between numerical-verbal ability pattern and educational and vocational interest. These findings lend reassurance that high school seniors are less likely to select a major field of college study which stresses a kind of mental ability (quantitative or verbal) in which they are relatively weak, than they are to select a major field in which they demonstrate relative strength.

#### EDUCATIONAL PSYCHOLOGY IN ITALY

(Publication No. 1203)\*

Joachim J. La Malfa, Ph. D. University of Michigan, 1949

This investigation may be described as a documentary study of the rise and development of educational psychology in Italy. It provides answers to a series of basic questions.

- 1. When did the study and teaching of educational psychology have their beginnings in Italy?
  - 2. For what purpose and by what groups was it sponsored?
- 3. Who were some of the leading educational psychologists in Italy and what were their contributions?
- 4. To what extent did concepts and procedures of psychology in other countries affect pedagogy in Italy?
  - 5. Did educational psychology affect teacher training in Italy?
- 6. Were the products of the laboratory researches utilized in school practice?
- 7. Was the scientific approach to educational methods and its use modified as a result of the change from constitutional monarchy to dictatorship?

<sup>\*</sup> Microfilm copy of complete manuscript of 272 pages, \$3.40. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-4.

In view of the fact that Italian psychological contributions have received only superficial mention in English literature, it is often assumed that little research of significance has been produced by the Italians. None of the attempts to review the development of psychology in Italy have yielded a complete picture, especially of the application of psychology to education. However, original articles and books covering the extensive work carried on in educational psychology in Italy from 1898 to 1939 provided adequate source material.

The foundation of the study of educational psychology in Italy was laid by the early anthropologists, who sought not only to describe physical traits and characteristics, but behavior patterns as well. These anthropologists were Cesare Lombroso, Achille De Giovanni, Maria Montessori, Nicola Pende and Giuseppe Sergi. As early as 1886, Sergi proposed the study of students by anthropological methods. He is also to be given credit for the founding of the first psychological laboratory in Italy, established by a Royal Decree of 1889.

Educational psychology has long been a branch of experimental psychology since the scholars who promoted educational psychology in Italy were from the experimental school. Therefore, the progress of scientific pedagogy is closely allied with the progress of experimental psychology. To this progress in psychology, Germany and the United States made significant contributions.

Psychology was considered, until the latter part of the nine-teenth century, synonymous with philosophy. It was not until an effort was made to approach educational psychology from a physiological and experimental point of view that it achieved an identity apart from philosophy. The effort to divorce psychology from philosophy gave rise to a heated controversey between the followers of "spiritual" philosophy and the positivists, a group of scientists comprised mostly of anthropologists, physiologists and physicians.

Educational psychology in Italy was sponsored for the purpose of democratizing the Italian nation through the education of its youth; to relate instruction to the actual needs of the individual child, and to scale the work to his intellectual and physical capacity.

From 1879 until 1916, various proposals were made to the state to utilize psychological findings by informing public school teachers through university courses, of the new methods of instruction based on the science of psychology. The state paid little attention to these suggestions and in 1916, cancelled all educational psychology courses offered at universities. This unfavorable attitude was not a new one since the first teacher training courses in educational psychology were sponsored by individual psychologists and were held at their

private laboratories or at homes purchased by them for teaching purposes.

The private schools that utilized psychological findings were also founded by psychologists. They were mostly for under privileged or feebleminded children, and the only income came either from private funds or small subsidies from the local community. At the beginning of the Gentile reform in 1922, the psychologists who hoped to realize their ideals through the new regime, offered suggestions based on their past experiences for the re-education of Italian youth. However, Gentile reform stressed philosophy and tradition while the psychologists favored experimentation in favor of the individual. Gentile called scientific pedagogy, "barbaric", and suppressed educational psychology courses at all universities. No sweeping order came to close the laboratories, but as each psychological director died a ceremony honoring his services to the nation marked the closing of the laboratory. Although the psychologists made attempts to revive child psychology by establishing free courses and private schools, they were no match for the Fascist political machine. Finally, the psychologists gave up their work and efforts for recognition of educational psychology, but succeeded in interesting the Fascist state in other phases of psychology in industrial and military.

## THE ANALYSIS OF HIPPED PLATE STRUCTURES CONSIDERING THE RELATIVE DISPLACEMENTS OF THE JOINTS

(Publication No. 1256)\*

Ibrahim A. Gaafar, Sc. D. University of Michigan, 1949

A hipped plate structure is a monolithic space structure that is composed of straight plate or slab elements that intersect at an angle. No beams or girders need be used as the plate elements are connected rigidly together to form a structural unit that has some of the characteristics of a shell type structure. The ends of the plate elements are supported by diaphragms and columns. These structures, which carry the loads applied to the plates by a combined slab and beam action, are usually built of reinforced concrete and are particularly applicable to roofs, bins, and bunkers.

The present approximate theory of hipped plate structures, as established by Ehlers and Craemer, neglects the effect of the change in shape of cross section under loading. The more exact theory for this problem as given by E. Gruber is mathematically complicated which may explain the reason for the adoption of the present approximate theory. However, a more exact, but still practicable method of analysis that considers the change in shape of the cross section is given by the method presented in the dissertation. Moreover, none of the previous mathematical investigations of the theory of hipped plate structures presented any experimental evidence to substantiate the assumptions and analytical procedures that were used.

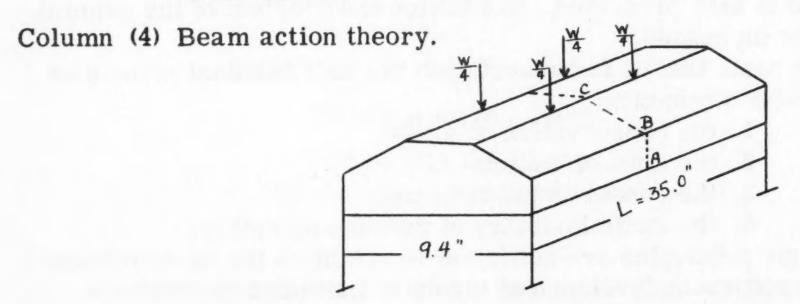
In the development of the analysis which is proposed in this thesis it was found necessary to depend upon a study of the deformations in small scale models to provide information upon which correct assumptions could be made. Tests on a 1/40 scale 24 S.T. aluminum model of a hipped plate roof 117 ft. x 31 ft. were conducted to check the assumptions and the analytical results.

Investigations showed that the change in the shape of cross section of such structures under loading, which is usually neglected in the present theory of design, affects the results materially. Discrepancies in the results of solutions that neglected the change in shape of the cross section of 100% and even up to 200% and more for for some cases were obtained.

<sup>\*</sup> Microfilm copy of complete manuscript of 124 pages, \$1.54. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-56.

A comparison of the longitudinal stresses measured on the 1/40 scale aluminum model at the edges of the plate elements with the theoretical values calculated by three different assumptions is shown in the following table. In this table, the information is recorded as follows:

- Column (1) The Ehlers and Craemer theory which neglects the effect of change of shape of the cross section.
- Column (2) The experimental values obtained from tests on the model.
- Column (3) The method of analysis proposed in this thesis which considers the effect of the change in shape of the cross section.



#### Maximum Longitudinal Stresses p.s.i.

Edge C B	(1)	(2)	(3)	(4)
	-1360 +2000	-820 +740	-925 +1020	-537 +166

Comparing these values of stresses it could be noticed that the stresses given by the analysis proposed in this thesis are more in agreement with the experimental results.

The stresses in the transverse direction which rule for the design of the plates as a continuous slab, are even more seriously affected by edge translation. The values obtained from the German theory are considerably lower than the measured values. The necessary correction for such stresses may be up to 320%.

#### THE GENERAL THEORY OF A CONTINUOUS MEDIUM

(Publication No. 1239)\*

Paul Frankilin Chenea, Ph.D. University of Michigan, 1949

This is a study of the basic mechanics of a continuous medium. The object of this dissertation is to present the general theory of a continuous medium as an integrated development from the axioms of classical mechanics. The specialization of this general theory to the specific continuous mediums, such as the ideal elastic body and fluid is also presented. In addition the problem of the general plastic is discussed.

The basic theory is founded upon the four cardinal principles of classical mechanics:

- 1. the conservation of mass
- 2. the laws of motion
- 3. the conservation of energy
- 4. the inadmissibility of decreasing entropy.

These four principles are sufficient to establish the basic theory. The kinematics is developed in terms of imbedded coordinates. The mathematical description of these coordinates is most easily given in terms of general curvilinear tensors. For this reason the tensor notation and calculus is used throughout. The equation of state and the dissipation equation are introduced to permit the stress-strain relations to be formed in a straight forward manner. The "dimensional" requirements of a tensor equation is utilized to achieve the maximum detail in these relations.

The results obtained in this dissertation are as follows:

- 1. A particularly short, accurate and physically significant kinematics of the continuum is developed.
- 2. The general form of the continuity equation is established.
- 3. The equations of motion for a continuum are derived.
- 4. The generalized heat conduction equation is obtained.
- 5. The stress strain laws for the elastic body and the fluid are presented in their most general form.
- 6. The necessary criterion for stress-strain relations in the general plastic is found.

<sup>\*</sup> Microfilm copy of complete manuscript of 84 pages, \$1.05. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-39.

7. A simple example of a theoretical plastic is investigated and found to have realistic properties.

The general conclusion is that the theory of a general continuum may be formulated within the framework of classical mechanics in a concise and significant fashion. This general theory may be made to form the basis for the general theories of elasticity and fluid mechanics. Further, the theory of the general plastic, established upon the fundamental theory of a continuous medium, has great promise in engineering mechanics. Admittedly, some of the anomalies of plastics, which arise out of their atomic or molecular make-up, may not be reproducible in the general continuum, but the framework of an adequate engineering theory appears to be present.

#### BENDING OF CIRCULAR PLATES

(Publication No. 1202)\*

Shin-Min Jen, Sc. D. University of Michigan, 1949

Summary

Thin circular plates of uniform thickness only are considered. The problems with which we are concerned deal with:

- 1. Small deflections of plates bent by lateral loading.
- 2. Small deflections of plates resting on an elastic foundation and under lateral loading.
- 3. Small deflections of plates bent by a combination of lateral loading and forces in the middle plane.
- 4. Large deflections of plates bent by lateral loading.

A general method is presented for solving the above four problems. For small deflection problems both clamped and simply supported edges are considered. For large deflection problems special edge conditions are specified. In each problem there is discussed first the case of symmetrical loading, and then the case of general loading.

The fundamental differential equations of the three problems of small deflection can be written in the form

(1) 
$$\Delta \Delta w = q + N_1 \left( \frac{1}{h} \frac{\partial w}{\partial h} + \frac{1}{h^2} \frac{\partial^2 w}{\partial \theta^2} \right) + N_2 \left( \frac{1}{h^2} \frac{\partial w}{\partial \theta} + \frac{1}{h} \frac{\partial^2 w}{\partial h^2 \theta} \right) + N_3 \frac{\partial^2 w}{\partial h^2} + wk$$

<sup>\*</sup> Microfilm copy of complete manuscript of 112 pages, \$1.40. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-3.

where r and  $\theta$  are independent variables, w is a function of r and  $\theta$ ,  $\Delta$  is the Laplacian operator,  $N_1$ ,  $N_2$ ,  $N_3$  and q are known functions of r and  $\theta$ , and k is a constant. The solution of the above equation can be expressed in the form

(2) 
$$w = w_1 + \sum_{n=0}^{\infty} \sum_{m=1}^{\infty} J_n (k_{nm} h) (A_{nm} \cos n\theta + B_{nm} \sin n\theta),$$

where  $w_1$  is the solution of the biharmonic equation  $\Delta \Delta w = 0$ ,  $J_n(k_{nm} \kappa)$  are the Bessel function in r of the first kind of order n,  $k_{nm}$ ,  $A_{nm}$ ,  $B_{nm}$  are unknown constants.

One boundary condition permits us to find the constants  $k_{nm}$ . The second boundary condition permits us to find relations of the form

$$C_n = C_n (A_{nm}, B_{nm}),$$

$$D_n = D_n (A_{nm}, B_{nm}),$$

where  $C_n$  and  $D_n$  are unknown constants involved in the expression for  $w_1$ . Now w is a solution of Eq. (1) if

(5) 
$$\sum_{n=0}^{\infty} \sum_{m=1}^{\infty} k_{nm}^{4} J_{n} (k_{nm} n) \left[ A_{nm} \cos n\theta + B_{nm} \sin n\theta \right]$$
$$= q + f (n, \theta),$$

where  $f(n,\theta)$  is a known function of r and  $\theta$  involving the constants  $A_{nm}$  and  $B_{nm}$ . The right side of this equation can be expressed in a Fourier-Bessel expansion. Hence we can obtain  $A_{nm}$  and  $B_{nm}$  by comparison of the coefficients of  $J_n$   $(k_{nm} n)$  cos  $n\theta$  and  $J_n$   $(k_{nm} n)$  sin  $n\theta$ ; then  $C_n$  and  $D_n$  are determined from Eqs. (3) and (4).

By the same method problems of large deflections can be attacked.

The present paper is divided into six chapters. In Chapter I the fundamental equations are derived and also the various boundary conditions are considered. In Chapter II various necessary theorems are stated and proved, and the method is outlined. In the remaining chapters the four problems mentioned above are discussed.

## THE INFLUENCE OF THE DIMENSIONAL FACTORS ON THE MODE OF YIELDING AND FRACTURE IN MEDIUM CARBON STEEL

(Publication No. 1255)\*

Julius Miklowitz, Ph.D. University of Michigan, 1949

An extended use of the facts learned from a detailed study of the local principal strains during uniform straining in a flat tension bar, has proven valuable in explaining the large variations of the local necking strains, with uniform changes in geometry and size of the bar. In presenting this work, Part I brings out the direct analogy that has been made between the restraining action of the bar heads on the gage material and that of the stagnant material of the neck on the flowing material adjacent to it. In both cases, the magnitude of the restraining dimension is the important variable, the degree of restraint increasing with an increase in dimension. A detailed explanation, in these terms, is offered to explain the results of several experiments with flat tension bars of variable size and geometry. The study in deformation is presented for both uniform straining and the complicated cross-like neck at fracture. The maximum strains in the neck increased when the bar size decreased. The maximum strain, in the lateral direction parallel to the bar width, became less as the width-to-thickness ratio of the bar increased from 1 to 7. Beyond this value, no effects were noted. The axial strain, calculated from the two lateral strains, reflected their trends.

The study has been extended to cover the size aspect of strain in the round tensile bar. This work is presented in Part II. Test results show an increase in axial strain, average-true stress and maximum-true stress at the minimum section of the neck of a round tension bar at fracture when the size of the bar is decreased. An explanation is given for this size effect on the axial strain. Use has been made of the deductions in the flat bar work of Part I concerning the importance of the magnitude of restraining dimension in building the restraint. Here, it is similarly suggested that the restraint on the flowing material at the heart of neck, created by lateral stresses induced by the adjacent stagnant material, is

<sup>\*</sup> Microfilm copy of complete manuscript of 123 pages, \$1.54. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number A 49-55.

dependent upon and increases with the diameter of the stagnant material; hence, the bar diameter.

Some metallurgical variations in the data of Part II are analyzed and discussed.

#### BENDING OF AN ELLIPTICAL PLATE BY EDGE LOADING

(Publication No. 1174)\*

William Arthur Nash, Ph.D. University of Michigan, 1949

In this paper a series solution is presented for the problem of the small deflections of a thin elliptical plate with the following boundary conditions:

(a) The edge of the plate is supported and is given a small prescribed deflection in a direction perpendicular to the middle plane of the plate.

(b) The external load applied to the plate consists of a general distribution of bending moments acting around the

edge of the plate.

Since the loading consists of moments distributed around the edge of the plate, the general Lagrange differential equation for the middle surface of the plate reduced to the biharmonic equation. Elliptic coordinates are used and the problem reduces to finding a solution of the biharmonic equation, in elliptic coordinates, which satisfies the boundary conditions.

Solutions to this equation are of two types: (1) Harmonic functions, i.e. those that satisfy Laplace's equation, hence are necessarily biharmonic, and (2) Biharmonic functions which are not harmonic. Functions of the first type are readily found by the method of separation of variables in Laplace's equation expressed in elliptic coordinates. Functions of the second type are found by the use of complex variable theory. The general biharmonic function in rectangular Cartesian coordinates is transformed to elliptic coordinates and the Fourier expansion of this biharmonic function is introduced to present the terms as functions of multiple angles instead of power functions. The Fourier coefficients are evaluated by residue theory and successive pairs of functions are then subtracted from one another to find the biharmonic functions. In this

<sup>\*</sup> Microfilm copy of complete manuscript of 66 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-383.

manner four classes of biharmonic functions, which are not harmonic, are found.

The portion of the major axis lying between the foci of the ellipse is a line of singular points and the conditions of continuity of deflection and gradient across this line impose additional restrictions on the solution. Because of these conditions some of the harmonic and biharmonic functions are not acceptable.

An expression for the deflection surface is formed of terms which satisfy the biharmonic equation and also satisfy the continuity conditions across the line of singular points. The coefficients of the terms in this series are determined by means of the two boundary conditions. A simple recurrance relation is given for these coefficients.

The numerical values of the first few coefficients in this series for the deflection surface are obtained for a particular elliptical plate with a uniform distribution of bending moments acting around the boundary, which is not given any deflection.

Previously, only a portion of the biharmonic functions presented here were known. The complex variable approach gave a sufficient number of functions to make the solution of this general problem possible. Only certain special symmetric loadings have been treated previously.

### WILDLIFE - A SECONDARY CROP ON FOREST LAND MANAGED PRIMARILY FOR TIMBER PRODUCTION

(Publication No. 1184)\*

Bryant Aurelius Bateman, Ph.D. University of Michigan, 1949

Forest-wildlife relationships and management practices to maintain or increase wildlife in the forest are discussed. Special projects were set up to study deer, squirrel, and bobwhite quail. Turkey, rabbit, furbearers and predators are discussed on the basis of general observations made during and prior to this study.

Deer confined in a corral were fed native forest vegetation and the relative palatability of the different species was ascertained. In addition, natural habitats carrying a high deer population were examined and the degree of browsing on different food plants was recorded. Winter foods in order of palatability were yaupon, smilax, Japanese honeysuckle, magnolia, yellow jessamine, and waxmyrtle. The most palatable summer foods were red mulberry, arrow-wood, titi, wild azalea, yaupon, smilax, Japanese honeysuckle, dogwood, blackgum and huckleberry. More available browse, especially that preferred in winter, was found in the pinehardwood than in the old hardwood forest stands.

Squirrel obtained an all-year food supply from tree buds, field crops, and many types of fruits. In the fall when mast was most abundant, beech, hickory, and the water oaks furnished the preferred food. In spring and summer, dewberries, blackberries, mayhaws, and mulberries were preferred.

In one instance, gray squirrel occupied a new territory in an upland area and established a stable population. In another locality squirrel abandoned the bottomlands when the food supply failed and spread into the surrounding pine-hardwood forest type. However, they returned to the bottomlands the following spring to nest in tree cavities.

Quail food plots established on cutover pine lands each held one covey of quail throughout the study although heavy grass, brush and pine reproduction were causing a gradual deterioration of the habitat. Most of these coveys disappeared after the plots were abandoned. Food plots established in forest stands of different densities

<sup>\*</sup> Microfilm copy of complete manuscript of 149 pages, \$1.87. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-393.

were unsuccessful except in openings made by a selective cutting. Sesbania, partridge pea, wild winter peas, and Augusta vetch were preferred for planting in food plots. On another study area a high quail population gradually decreased and finally disappeared when the habitat, originally composed of open forest and cultivated land, was transformed into a fully stocked forest.

Annual burning was used successfully to control hardwoods in immature pine stands. Following three years of no burning, hardwoods were again readily controlled by a light early spring fire.

Based on the findings of the study, it is believed that forest and wildlife management can be integrated on most areas in the Gulf States so that satisfactory production of each can be maintained. The forest is the natural habitat for deer, squirrel and turkey, and forest management practices will require only slight modifications to insure ample and vigorous populations of these animals. Quail are not so well suited to the forest and their production should be attempted only where good forest practices create a suitable habitat. These conditions may be found on forest lands being restocked naturally to longleaf pine.

## THE ALLELIC VARIABILITY AND ACTION OF THE GENE R IN MAIZE

(Publication No. 1276)\*

Seymour Fogel, Ph.D. University of Missouri, 1946

The unselected sample of twenty-two Rr alleles extracted into a relatively isogenic background is classifiable into four major groups on the basis of leaf-tip and anther coloration: Group A, colorless tip and green or near green anthers; Group B, weakly colored tip in approximately 50 per cent of the plants and weakly colored anthers; Group C, moderate tip and dilute purple anthers; Group D, strong tip and full purple anthers.

Difficulties in comparing the action of various R alleles due to the effects of uncontrolled modifiers and environmental factors has been minimized by studying, wherever possible, sib populations derived from the type  ${\rm cross}\,{\rm R}^{\rm r}/{\rm r}^{\rm r}\,{\rm x}\,{\rm rg}$ . The completely linked aleurone color difference permits positive separation of the con-

trasted genotypes.

Minor differences in phenotypic expression among alleles of Group D have been established in experiments involving the use of aleurone mutants for the alleles of this class. The significance of such differences are demonstrable in objective classification of the seedlings or flowering plants. No duplicates in phenotypic effect were found and the alleles were seriable in the decreasing order of effect: R-Boone::Cornell::Ponca::Plain::Black Beauty.

Alleles of Groups B and C, characterized by pigmentation of the pericarp and silks, in addition to other plant color features, have been demonstrated to be non-identical with one another on the basis of the degree of departure from a closely matched standard allele, r-Black Beauty. The type cross involved was R<sup>X</sup>/r-Black

Beauty x rg.

In the absence of aleurone mutants or suitable r stocks, differences among the R alleles of Group A were sought in terms of the degree of interaction effect with specific modifiers. Since the alleles of Group A exhibited widely different levels of interaction effects, and moreover, since the seriation of effect is different for different modifiers, it is concluded that few or no duplicates in phenotypic effect exist within this group of isoalleles. Alleles of

<sup>\*</sup> Microfilm copy of complete manuscript of 157 pages, \$1.97. Enlargements 6" x 8", 10¢ per page. Library of Congress 94 Card Number Mic A 49-76.

Groups B, C, and D fail to show interaction effects with these modifiers.

In their effects upon the tissues chiefly involved in the coloration of the seedling organs and of mature leaf sheath, blade, margin, anthers, husks, glumes, etc., the alleles form a substantially linear series. Certain alleles produce only faint pigmentation restricted to a few tissues; others produce pigmentation of varying intensity in a wide variety of tissues. The effects of the entire series may be fairly well represented in a single graph in which an arbitrary potency value is assigned to each allele and a hypothetical threshold to each tissue.

The same alleles are decidedly non-linear in other aspects of plant color effect. Several alleles intermediate in coloration of the above tissues produce intense pigmentation of the silks, pericarp, auricles, pulvinus, etc. Numerous instances of such uncorrelated effects have been found for the various tissues and also on the histological level for different cell types within a single tissue.

The inheritance of anthocyanin pattern follows a simple rule. Presence of pigment is dominant to its absence and stronger pigmentation is dominant over weaker pigmentation. Compounds of alleles with non-linear effects exhibit anthocyanin in all regions of the plant colored by either parental allele.

Although the various alleles behave as though composed of seven or more completely linked genes or subgenes, it is not implied that these more or less independent components represent independent self-reduplicating units rather than different aspects of the action of a single unit. The term "independent component of action" is used throughout in the same sense that the plant and aleurone effects of R are considered independent. Each component of action may occur at any one of several levels and apparently any combination of levels may occur together in a single gene.

Colorimetric procedures developed in this study have made possible the investigation of allelic differences from a quantitative viewpoint. The shape of the time course curve of anthocyanin synthesis in cultured excised leaf sections is the same for the different alleles of R. Significant differences in the slope of the straight line region of these sigmoid curves are found to depend in a large measure upon the action of the R allele. The slope may be considered as a rate constant characteristic for each allele.

The total quantity and rate of anthocyanin synthesis has been demonstrated to depend upon some efficiency factor. The efficiency with which glucose (taken up at the same rate from the external solution), is converted to anthocyanin differs significantly for different alleles.

The technical and theoretical difficulties in studying allelic differentiation and gene action are discussed.

### DEVONIAN-MISSISSIPPIAN FORMATIONS OF SOUTHEAST IOWA

(Publication No. 1226)\*

Leo Almor Thomas, Ph.D. University of Missouri, 1947

This report sets forth the results of a study of the Devonian-Mississippian contact, and Lower Mississippian formations of southeast Iowa. Conodont assemblages from this division of the geologic column in Iowa have not been described previously. The conodont assemblages are employed as a stratigraphic aid for correlating the formations more closely along the area of surface exposures, and with their equivalents in Missouri.

In southeast Iowa all formations between the Burlington and Cedar Valley limestones, with the exception of the Sweetland Creek shale, have been studied. Of these units, only three have been productive of conodonts, the Maple Mill shale, the English River silt-stone, and the Prospect Hill siltstone.

The conodont assemblage from the Maple Mill shale consists of 46 species representing 19 genera. One genus and 24 species of conodonts from the Maple Mill are here described as new. The conodont assemblage indicates an Upper Devonian age for the Maple Mill shale. The Maple Mill shale is shown, by means of well sections, to grade laterally into the Grassy Creek shale of Missouri.

The conodont assemblage from the English River siltstone consists of 40 species representing 17 genera. Nine new species of conodonts are described from this unit.

The conodont assemblage from the Prospect Hill siltstone consists of 32 species representing 15 genera. Nine new species of conodonts from this unit are described. The assemblage from the English River siltstone, and the Prospect Hill siltstone indicates a Lower Mississippian age for these two units. The conodont assemblages are related to those of the Bushberg and Hannibal formations of Missouri.

The English River, and Prospect Hill siltstones are shown to grade laterally, in well sections, into the Hannibal formation of Missouri. The English River, McCraney, and Prospect Hill units of Iowa are classified as members of the Hannibal formation.

The Louisiana limestone of Missouri is shown to be Devonian in age, and can not be considered as a time equivalent of the Mc-Craney limestone of Iowa.

<sup>\*</sup> Microfilm copy of complete manuscript of 137 pages, \$1.72. Enlargements 6" x 8", 10¢ per page. Library of Congress 96 Card Number Mic A 49-26.

#### THE ROMAN VETERANS IN EGYPT

(Publication No. 1233)\*

Abdellatif Ahmed Aly, Ph.D. University of Michigan, 1949

Meyer's book, Das Heerwesen der Ptolemaer und Romer in Agypten, was published in 1900, and Lesquier's masterly work, L'Armee romaine d'Egypt, came out in 1918. The former is now out of date in many points and cannot be used without extreme caution. The latter remains the standard work on the subject although a few sections of it call for revision. As its title indicates, this book is concerned primarily with soldiers still in service and the problems connected with their discharge. Lesquier made no attempt to follow the veterans into the chora where they settled and consequently he gave no account of their life as civilians. In 1936, Nesselhauf published the sixteenth volume of the Corpus Inscriptionum Latinarum containing an excellent collection of all the military diplomas known up to that date. The appendices include also most of the epicrisis records of Roman veterans and other related documents. This is followed by a discussion which is devoted entirely to military matters. Other works recently published occasionally deal with the veterans of Roman Egypt but, so far as I am aware, none of them contains a survey of all their problems.

This study aims partly at supplementing the works just cited but mainly at drawing a picture of the life of veterans who settled in Egypt after their discharge from the Roman army of occupation between 30 B.C. and 324 A.D. It begins with a study of all the terms used in our documents to mean 'veteran.' Veterans are divided into naval, auxiliary, and legionary, and their problems are treated separately. The controversial issues of their discharge, diplomas, and epicrisis are re-examined in the light of evidence that has been recently discovered. All the 'extracts from volumes of examinations' are grouped and discussed together with emphasis being laid on those bearing directly upon the veterans. Important documents are given due attention. Vital problems such as the status of veterans, legitimacy of their children, and marriage with peregrine wives are dwelt upon. Inadequate documentary evidence is sometimes supplemented by juristic data. The immunity

<sup>\*</sup> Microfilm copy of complete manuscript of 312 pages, \$3.90. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 40-33.

liturgies, and magistracies of veterans are illustrated by discussions of the pertinent documents. Very little has been added to our information on the colonies of veterans in Egypt and consequently the question is left open. The new evidence supplied by the papyri and particularly by the Michigan Collection has made it possible to draw a list of all the Antinoite veterans known so far and to make more definite statements on the status of their dependents. When the evidence is abundant, the discussion is corroborated by excursuses in the footnotes, by tables and commentaries on them, and by a detailed study of family-archives.

All certain items of information have been utilized to write a survey of the economic status of veterans who were mostly landowners and tenants. This is sometimes illustrated by the amount of land owned by them, by the sums they borrowed and lent, and by the documents in which they figure as owners of slaves and other property. The veterans' social standing in the community, their relation with the administration, with their fellow citizens, and with each other are also stressed. A chapter is devoted to the rights of soldiers and veterans with regard to making wills. The testament of C. Longinus Castor has been thoroughly analyzed with a view to showing the essential elements of a Roman will as influenced by Hellenistic law. The dissertation concludes with a brief survey of all the documents bearing on the popularity of military service, social and religious life of the veterans, and their epitaphs.

A prospographia of all veterans in Roman Egypt is appended to the dissertation containing information which, I hope, will make identification easy. Under 'Remarks' in the last column of the table, cross references are given to pages and footnotes where any

given veteran has been dealt with.

#### CLASS AND CLASH IN SEVENTEENTH CENTURY MEXICO

(Publication No. 1201)\*

Lewis Maloney Hoskins, Ph.D. University of Michigan, 1946

Social and economic conditions during the seventeenth century in Mexico were so unsatisfactory to the masses, that, finding no better means of righting their grievances, they resorted, on numerous occasions, to violent upheavals. Their rebellions against conditions under which they lived focus in intense hatred of the Spaniards who dominated the economic, social, and political structure. These social revolts reveal basic errors of Spanish colonial policy. Because statesmen in Spain did not remove these grievances the unrest continued until efforts for independence triumphed in the early nineteenth century.

The colonials resented the mercantilistic policy of the mother country and their exploitation at the hands of the Spaniards in Mexico. Their lack of political rights was irratating to more enlightened colonists who desired opportunity to achieve reforms by political action. Finally, by the seventeenth century almost every member of colonial society resented the social structure which had emerged. In the mixture of races which inevitably followed the arrival of Spanish conquistadores and negro slaves, there developed a complex ethnical mixture as a result of the wide-spread miscegenation. This evolved a class structure approximating a casts system. The Spanish legally recognized up to eighty different class groupings and deliberately perpetuated the system on the theory of "divide and rule." Because vertical mobility was not permitted, the colonials felt social frustration which aggravated all of their other grievances. They saw no hope of improving their lot and thus were susceptible to any leadership which might take advantage of this revolutionary frame of mind.

Among the numerous revolts of the century, five will typify the various forms of unrest. In 1609 a group of negroes fled to the hills of Vera Cruz and set up an isolated, utopian community. When they began to plunder the neighborhood, the Viceroy sent an expedition to conquer them and then to set up a new settlement for free negroes under proper supervision.

<sup>\*</sup> Microfilm copy of complete manuscript of 241 pages, \$3.02. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A49-2.

The cross-section of social alignments and the multifold grievances of the population of Mexico City are revealed in the riot which developed in 1624. Caused by a monopoly-induced food shortage, and superficially appearing to be a church-state quarrel, the disturbances eventually settled down into the basic economic complaints of a slum population against the socially superior and wealthier Spaniards. The riot which resulted caused considerable damage to property and life and brought about the temporary deposition of the Viceroy and the ascendancy of the audiencia and the archbishop.

Not entirely crack-pot was the scheme of Don Guillen de Lampart to make Mexico independent under his rule. An ambitious, well-educated pastry-cook, Lampart became embroiled in the tenacles of the Inquisition and his elaborate plan of revolt failed to materialize. The plotter finally met his death at an auto de fe of the Inquisition after seventeen years of imprisonment.

Not only were the Indians constantly resisting Spanish encroachments along the frontier, but those who had been brought into the colonial society were forced at times to protest violently the exploitation which they faced. In 1660 an uprising occurred in Tehuantepec. The natives revolted against their officials and were only pacified by the Bishop of Oaxaca and an oidor sent from the capital, who promised reforms.

The capital was the scene of another disastrous tumult in 1692 when the populace rose against the Viceroy during a famine induced by a series of natural catastrophes. This corn riot resembled the earlier disturbance although the complicating factor of church-state relations did not enter. Even greater damage was done the royal palace than before, but the Viceroy was able to retain power and to punish the culprits while he made further efforts to relieve the famine.

All of these disturbances reveal the complexity of political, economic, and social grievances causing unrest during the colonial period. The caste system loomed large among the complaints and became an aggravator of others. Because adequate reform measures were not forthcoming, these same grievances finally served to unite the colonials in a movement for independence which was made possible by the general dislocation of European politics in the early nineteenth century. Many of the problems were then inherited by the new republic.

### NORMAN J. COLMAN AND COLMAN'S RURAL WORLD: A STUDY IN AGRICULTURAL LEADERSHIP

(Publication No. 1280)\*

George F. Lemmer, Ph.D. University of Missouri, 1947

Norman J. Colman, who became Missouri's foremost agricultural leader and the first United States Secretary of Agriculture, was born near Richfield Springs, New York, in 1827. He was educated in the public schools and academies of New York, and when twenty years of age moved to Kentucky, taught school, and took the Bachelor of Laws degree from the University of Louisville. More interested in agricultural reform than in a legal career, he soon settled at St. Louis, where he purchased a farm, established a large nursery, and bought Missouri's leading agricultural journal,

the Valley Farmer.

As publisher and editor of this journal, called Colman's Rural World after 1865, he became a well known proponent of agricultural reform in the Midwest. The paper disseminated a vast amount of information on scientific breeding of livestock, crop rotation, soil conservation, and other phases of scientific agriculture, and Colman took the lead in organizing associations to support these ideas. He was the founder of the Missouri State Horticultural Society, a leading figure on the Missouri State Board of Agriculture for over forty years, and a member of the Board of Curators of the University of Missouri for fifteen. As a member of these groups, he exerted his growing influence toward founding the Missouri College of Agriculture and obtaining adequate appropriations for its support. Colman's Rural World always gave the new institution favorable publicity and helped to popularize it with farmers. He also maintained close contact with farmers and their problems, taking an active part in organizing local associations and addressing audiences at county fairs. As an experimental fruit and livestock farmer, Colman was able to give much practical advice to the patrons of his journal.

Colman's prominence as an agricultural leader in the Mississippi Valley resulted in his being appointed Commissioner of Agriculture by President Grover Cleveland in 1885. He was

<sup>\*</sup> Microfilm copy of complete manuscript of 407 pages, \$5.09. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-80.

instrumental in establishing, while Commissioner, the system of federally supported agricultural experiment stations in connection with the land grant colleges, and the Office of Experiment Stations as a special division in the Department of Agriculture. These, in conjunction with the American Association of Agricultural Colleges and Experiment Stations, also formed largely through Colman's efforts, first brought state and federal agencies into harmonious cooperation. His skill and efficiency greatly facilitated the transition of the Department to cabinet status. This change was made February 9, 1889, and Colman became the first Secretary of Agriculture.

Colman was always a strong spokesman for the farmers and protested vigorously against "agricultural inequality." He served one term in the Missouri state legislature and twice ran for Lieutenant-Governor on the Democratic ticket. In 1874 he was elected to that office. He was one of the leading figures in the Granger movement in Missouri, and Colman's Rural World was that order's official organ for several years. Between 1889 and 1892 Colman was active in the Farmers' Alliance, but broke with that group upon the founding of the Populist Party.

Colman spent his later years in Missouri, editing his journal, serving on the Board of Agriculture, and raising standard-bred trotting horses. He was the first president of the Missouri State Fair Association, organized in 1899, and became one of the leading proponents of improved public highways. He died on November 3, 1911, at the age of eighty-four.

### THE LIFE AND TIMES OF CHARLES DANIEL DRAKE

(Publication No. 1282)\*

David DeArmond March, Ph.D. University of Missouri, 1949

One of the most controversial personalities in Missouri politics during the 1860's was Charles Daniel Drake of St. Louis, leader of the Radical Republican movement which held sway in that state from 1864 to 1871.

<sup>\*</sup> Microfilm copy of complete manuscript of 471 pages, \$5.89. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-82

Charles Drake was born in Cincinnati, Ohio on April 11, 1811, the only son of the nationally famous medical scholar and practitioner, Daniel Drake. After a brief career in the United States Navy, Drake studied law in the offices of his uncles and was admitted to the bar in Cincinnati in 1833.

Drake went to Missouri in 1834. After an unsuccessful experience in the collection of accounts for eastern firms doing business with St. Louis merchants, and an even less remunerative participation in the Whig political campaigns of 1844 and 1848, Drake achieved recognition as an able lawyer. In 1854 his Treatise on the Law of Suits by Attachment was published.

In 1859 he was elected as a Democrat to the General Assembly of Missouri where he succeeded only in alienating fellow legislators by his egotistical and overbearing attitude, and in incurring the enmity of the Germans in Missouri.

When the clouds of secession and war darkened temporarily the roseate picture of Missouri's economic future, Drake contributed to the Union cause by rationalizing in public speeches and in the newspapers the position most Missourians wished to take on the question of secession, continued adherence to the Union.

Beginning in 1861 Drake's attitude toward slavery moved through a series of steps from defense of the institution to the position that only traitors opposed immediate and unconditional emancipation. Slavery, in his mind, was the cause of the "crime" of secession. Because of such views, augmented by his crusading spirit and overweening desire for recognition, Drake soon was a leader of the Radical Republicans in Missouri.

The Radical party claimed to be the party of economic and social progress as it moved from one objective to another. Drake participated in the state convention of 1863 where he advocated the immediate abolition of slavery in Missouri. He attacked the gradual emancipation scheme passed by the Conservative majority in the convention.

In the fall of 1863 Drake led a "Committee of Seventy" Radicals to Washington in an attempt to get President Lincoln to abandon his support of the Conservative Hamilton R. Gamble administration. Although Lincoln refused their principal demands, national attention was called to the Radical movement in Missouri.

Although there was a great deal of opposition among the Missouri Radicals to Lincoln's nomination and election in 1864, the leaders of the Radicals managed to avoid a disastrous split when the party organization supported him. The Radicals secured control of the state government in that election.

In 1865 the General Assembly called for the election of delegates to a convention in order to amend the Constitution so as to

abolish slavery and disfranchise disloyalists. Drake was the leader in that convention and succeeded in his plan to have the convention frame and adopt a new constitution for the state. The result was the Constitution of 1865 with its "Kucklebur Oath."

Drake successfully defended the Constitution with its proscriptive provisions in the campaign for ratification in 1865 against the attacks of the Conservatives and disgruntled elements within the Radical party. He took upon himself a great part of the burden in the Radical campaign of 1866.

In recognition of his services the Radical General Assembly elected Drake to the United States Senate in 1867. From that position Drake attempted to control the Radical party. That he was unable to maintain his control very long was due to his own political ineptitude and to his failure to lead the party in a positive program. His influence was seriously undermined when the Radicals elected Carl Schurz to the Senate in 1869 despite Drake's vehement protest.

After the Radical defeat by the Liberal Republicans in 1870, President Grant appointed Drake to the office of Chief Justice of the Court of Claims, a position he held until 1885 when he resigned. He died in Washington, D.C. in 1892, and was buried in St. Louis.

## MORPHOLOGICAL AND HISTOLOGICAL RESPONSES OF THE CHERRY (PRUNUS AVIUM L. AND PRUNUS CERASUS L.) TO FALL APPLICATION OF PLANT GROWTH REGULATORS

(Publication No. 1209)\*

Sundaram Krishnamurthi, Ph. D. Michigan State College, 1949

- 1. Bearing trees of the Montmorency sour cherry (Prunus cerasus L.) and of the Schmidt sweet cherry (Prunus avium L.) in the experimental orchard of the Michigan State College, East Lansing, (one in each of them), were sprayed in the fall (September 22, 1947) with a mixture of 100 p.p.m. of 2,4-dichlorophenoxyacetic acid and 30 p.p.m. of naphthal eneacetic acid. One of each was left untreated for comparison. The trees were examined and plant materials collected, for observations of morphological and histological responses to the treatment through the next growing season.
- 2. Injury to vegetative and floral buds, spurs and twigs resulted in reduction of leaf area and fruit set. Light, vigor and the method of spraying influenced the degree of injury.
- 3. Abscission of plant parts in most cases was completely prevented. There was very little relation between the effectiveness of plant growth regulators in preventing abscission and the anatomical nature of the abscission zones of the various plant organs.
- 4. The opening of floral and vegetative buds was delayed and very irregularly distributed.
- 5. The fruit was markedly modified. The elongate shape, lighter color, thick skin, reduced quality and color of flesh and juice, increased weight, an enlarged stone, with a rough and ridged surface, and a shape similar to the fruit, and a thicker and firmer pedicel were among the outstanding modifications. In spite of all these changes, the size of the fruit remained the same.
- 6. The vascular tissues in the fruit were abnormally proliferated, forming a massive network which was localized adjacent to

<sup>\*</sup> Microfilm copy of complete manuscript of 172 pages, \$2.15. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-10.

the stony pericarp and adherent to it. The hypodermal layer of the fruit showed undue tangential elongation and enlargement.

- 7. Histological study of the pedicel, the petiole and midrib of leaves showed cell enlargement in almost every tissue, increased development of the vascular system, particularly of the phloem, increase in size and continuity of pericyclic fibers.
- 8. Almost every part of the flower was affected. The calyx lobes, petals and stamens all had a definite tendency to bend towards the axis. Calyx lobes, and petals, increased in their length/breadth ratio, thickness, and vascular system. The filaments of stamens were longer and thicker and the anthers larger and pointed. The style was thicker and a portion of it persisted on the mature fruit.
- 9. The leaf showed hyponasty at emergence. The expanded leaves were generally narrower, longer, thicker, with acutely pointed tip, deeper and more numerous serrations, and with a very strong and thick petiole, midrib and venation. The internal structure showed enlargement of cells and intercellular spaces.
- 10. The fruits ripened earlier, the storage quality depreciated. In chemical composition, dry matter and total sugars decreased in the pulp but increased in the fruit as a whole.
- 11. The role of phloem in transmission of the stimulus was discussed.
- 12. An orderly succession of responses was noticed beginning with the time of treatment and was related to the stage of growth of tissues and organs.
- 13. The general influence of growth regulators in increasing vascular development was discussed.
- 14. The role was discussed of the stony pericarp, the vascular pattern and cell-elongation in determining shape.
- 15. The preponderent effect of 2,4-dichlorophenoxyacetic acid was explained.
  - 16. Practical applications of the results are listed.

### ROOTSTOCKS FOR PEARS WITH SPECIAL REFERENCE TO SCION ROOTING AND COMPATIBILITY

(Publication No. 1210)\*

Gurcharan Singh Randhawa, Ph. D. Michigan State College, 1949

#### PART I

Rootstocks for Pears.

The literature on rootstocks for pears has been reviewed with especial attention to the possibility of obtaining better rootstocks. Improved rootstocks should be blight-resistant, adaptable to various soil and climatic conditions, and, at the same time, congenial with most of the leading commercial pear varieties.

Domestic pear seedlings (Pyrus communis, L.) are commonly employed as rootstocks for the pear in North America, being raised usually from Bartlett seeds. Unfortunately, they are susceptible to fire-blight (Erwinia amylovora, Burril) as well as pear aphis. Many Oriental species, supposedly more resistant to fire-blight and to pear root aphis, have been tried. But some of the pear varieties produce black-end fruits on most of these stocks. At present, therefore, the Domestic pear remains the best standard pear rootstock in North America.

The Angers quince (Cydonia vulgaris, L.) is commonly used to dwarf the pear. Sometimes a blight resistant variety of Pyrus communis, as Old Home, is worked onto the quince and the graft-union set 10 to 12 inches below the ground level in order to encourage scion rooting. In this way the tree is furnished with blight resistant roots, trunk, and scaffold branches.

#### PART II

Effect of Scion Rooting on Growth and Cropping of 14-year old Dwarf Pear Trees.

Four pear varieties on French pear seedlings and on selected clonal quince (Quince A) rootstocks were planted in clay loam soil at Vineland, Ontario, Canada, in the fall of 1932. Half of the trees on quince were placed with the graft union about 6 inches below soil level. In other cases the union was about an inch above soil level, but many of these unions become covered with soil during cultural operations.

<sup>\*</sup> Microfilm copy of complete manuscript of 215 pages, \$2.69. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-11.

In the examination of root systems of excavated trees it was necessary first of all to devise methods of identification of pear and quince roots so that scion roots could be definitely separated from stock roots. All roots were measured with a caliper or a tape at a point as near as possible to their origin from the main axis. From these figures the total cross-sectional areas were computed. The percentage that the scion roots bore to the total root system was considered a measure of scion rooting. The age of the scion roots was determined from a count of the annual rings at the point of origin.

Under conditions at Vineland, the trees planted with the union 6 inches below ground level did not begin to develop scion roots until the 7th to 10th year after planting. Then, scion roots developed rapidly, the quince root became less and less important, and in some instances it was dead at the end of the 14th year. In this orchard, scion roots did not exert a repressive influence on fruiting. Varieties varied considerably in their capacity to develop scion roots.

#### PART III

Studies in Incompatibility between stock and Scion of Dwarf Pear Trees.

It is a familiar fact that some pear varieties do not produce a congenial union with the selected clonal quince rootstock, Quince A. Nurserymen, nevertheless, propagate such varieties on this rootstock and sell them to fruit growers. These plants make good growth for a year or two, but subsequently decline. If they survive for any great length of time, they may break clearly at the point of union.

The following tests were made to determine the stock-scion incompatibility of different combinations: (a) Swelling at union, (b) obstruction to the passage of water and elaborated foods at the union, (c) bark and wood discontinuity, (d) strength-at-union, and (e) nature of fracture at the union.

The following pear varieties were found to produce poor unions when worked directly on Quince A: Bartlett, Kieffer, Clapp Favorite, and Seckel. For orchard purposes, these varieties should be double worked with Beurre Hardy or Old Home as the intermediate stocks, which are compatible both with the quince rootstock and the desired scion variety. The following varieties make strong unions with Quince A: Beurre Hardy, Old Home, and Anjou. All the stock-scion combinations, whether dwarf or standard, which showed premature autumnal leaf coloration or early defoliation, were found uncongenial.

#### PART IV

Relationship Between the Graft-union, Autumnal Leaf Colors, and Growth and Fruiting of Standard Kieffer Pear Trees.

In most of the Kieffer pear orchards in Eastern United States and Canada a proportion of the trees show premature autumnal leaf coloration (September and October) and bear under-sized fruits of poor quality. The trees which have shown early autumn leaf coloration in nursery and orchard are usually dwarfish and show higher than normal mortality in the orchard.

In comparison to the red-leaved trees the green-leaved trees bear fruits with an appreciably higher content of total solids and ascorbic acid. The fruits from the formers are more gritty and astringent, and have a thicker hypodermal layer than fruits from the green-leaved trees. Premature autumn coloration of the leaves of the Kieffer pear, and small size and poor quality of fruit are due to nutritional difficulties brought about by a poor graft-union. A low level of nitrogen and calcium seems to favour anthocyanin formation in Kieffer leaves, and is correlated with poor unions.

A better rootstock for Kieffer is desirable. Unless such a rootstock becomes available it may be wise to grow Kieffer on its own roots. At present, the best plan appears to be the elimination of all small red-leaved Kieffer trees from the nursery. Very dwarfish Kieffer trees in the orchard should also be replaced.

#### STOCK-SCION RELATIONSHIPS IN TOMATOES

(Publication No. 1211)\*

Atma Singh, Ph. D. Michigan State College, 1949

Horticultural literature records numerous instances of variations caused by the interaction between stock and scion. Most of the variations may readily be explained as results of well-known growth reactions, but in other cases the fundamental reasons are not known.

It has been believed for a long time that genetic interaction between stock and scion be possible. However, such an interaction has not been demonstrated. The recent claims of Russian scientists to have established the possibility of graft hybridization have inthem to postulate new theories of inheritance.

In the paper presented results are reported of studies on stock-

<sup>\*</sup> Microfilm copy of complete manuscript of 78 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-12.

scion relationships in tomatoes, undertaken for the purpose of ascertaining whether or not the Russian claims were justified. In addition results of other physiological studies having a bearing on the problem are presented.

Several graft combinations of plants of tomato varieties differing in fruit characters such as color, shape, size and number of locules were made using the splice method of grafting. Approximately six-week old plants, from which the flower buds were removed at the time of grafting, were used as stock. The scions were obtained from three-week old plants without any visible signs of flower primordia. The effects on the development of fruits of defoliated shoots of one graft symbiont under the influence of the other symbiont were observed. No changes in visible characters of the fruits of a variety, which developed under the influence of leaves of another variety, were produced which might indicate an interaction between stock and scion. Analyses of fruits from graft symbionts for total soluble solids, titratable acidity and ascorbic acid also revealed no changes in fruit composition. These results suggested that an interaction between stock and scion of the kind claimed by the Russians is unlikely when plants are grafted at the stages of growth mentioned. However, the results reported are considered inadequate for final conclusions because of the scope of the problem. The need for more work on grafting stocks and scions selected on the basis of different physiological ages is emphasized.

Studies on ascorbic acid content of fruits were made on reciprocal grafts of two varieties differing greatly in their capacity to synthesize ascorbic acid. It has been demonstrated that the formation of ascorbic acid proceeds in the green assimilating parts independently of the root system. No rootstock influence was observed.

The ascorbic acid content of fruits of one variety which developed under the influence of the leaves of the other variety was not changed appreciably. The total soluble solids and acid contents were also not influenced.

No definite conclusions could be drawn as to whether ascorbic acid is synthesized in the leaves and then translocated into the fruits or is independently produced in the fruits. It is suggested that there may be a mechanism in the fruit to prevent the accumulation of ascorbic acid if it is synthesized in the leaves and translocated to the fruits or to prevent its synthesis beyond certain limits under a given set of environmental conditions.

The results of experiments with reciprocal grafts of normal plants and plants, in which typical morphological changes had been induced by the use of sodium 2,4-dichlorophenoxyacetate, showed that the formative stimulus can be transmitted through graft unions from stock to scion. The stimulus is considered to be of chemical nature but its actual form has not been determined.

### EVOLVING CONCEPTS OF INDUSTRIAL EDUCATION IN THE THINKING OF ORGANIZED LABOR

(Publication No. 1225)\*

Morris Ray Karnes, Ph. D. University of Missouri, 1948

#### Purpose:

The problem of this study is to trace the evolution of concepts of industrial education in the thinking of organized labor from 1880 to 1948 and to ascertain historically, analyze, and interpret the attitudes of labor toward the major issues involved in the problem of industrial education.

#### Summary:

- 1. When it became apparent to organized labor that, through the agitation of employers and certain educators, the development of a comprehensive system of specific vocational-industrial education in the public schools was inevitable, labor concluded that continued opposition would be of no avail. After much hesitance and serious thought, the American Federation of Labor and affiliated unions, driven by the fear of the public program under the domination of employers, joined in 1909 the national movement for vocational education in the public schools, and by 1917 had become one of the strongest forces in that movement.
- 2. Until about 1900, control of entrance to the trade remained the fundamental basis for labor's interest in industrial education, but since that date has gradually made way for other considerations bearing on the economic welfare of wage earners and on the maintenance of a strong union.
- 3. Both in industry itself and in programs for the training of industrial workers organized labor has opposed from the very beginning every development that contributed to specialization. Consistently labor has favored a broad, basic, fundamental general industrial training over narrow, specific instruction.
- 4. Labor has insisted that the public industrial school's only course is to maintain a neutral position with regard to the labor-management conflict. At the same time it has demanded that the public schools teach in an unbiased manner the history and problems

<sup>\*</sup> Microfilm copy of complete manuscript of 407 pages, \$5.09. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-25.

of the labor movement, industrial relations, and the principles of unionism and collective bargaining.

5. Under the traditional system of apprenticeship, the employer's responsibility for training the apprentice was taken for granted by all concerned. Basically, labor is still of the opinion that the training of industrial workers is in large part the responsibility of the employer. It has learned from practical experience, however, that the training which the employer is willing to provide and the comprehensive instruction which the trainee should have are two drastically different programs, and insists that public agencies must be made responsible for industrial training.

6. Labor has agreed that control of education must remain with the state's local communities. However, except for a brief period following 1938, the American Federation of Labor and the interested affiliated unions have continued to work for specific provisions and safeguards in federal legislation in order to protect labor's interest.

7. From the beginning of its interest in education organized labor has insisted that any system of education that designates, intentionally or otherwise, one school for wage earners and another for other classes, or in any way attempts to accentuate class lines, is inconsistent with democratic ideals, and that vocational education be made a function of the regularly constituted public school system under unified administrative control.

8. One striking feature of labor's educational pronouncements is the incessant claim that it is only through the close cooperation of educators, labor, and employers that a practical program in industrial education can be developed.

9. Never has labor been willing to permit any form of vocational education to interfere with the highest possible general, cultural

development of high school youth.

10. Except for labor's adverse criticisms of manual training around the turn of the century it has made very few direct references to general industrial education. Its descriptions, however, of the type of industrial program that it would have the public school offer fairly well coincide with a well-conceived program of industrial arts.

11. While labor's early concept of vocational guidance was limited to the selection of the occupation by the student, its understanding of this important educational service has gradually expanded to include a complete program of guidance and counseling which will lead to occupational adjustment.

12. Labor has been generally opposed to the cooperative parttime program. At the outset it approved certain desirable features of this system of training. There are so many opportunities for exploitation, however, that labor is not at all convinced that the program, as it has been administered, is a sound educational adventure.

- 13. Recognizing that the placement of union members in vocational schools is the best single means of ensuring the maintenance of high standards and the development of the proper attitude toward unionism on the part of the student, labor has made every effort to get union men employed as instructors.
- 14. Labor has been inclined to evaluate industrial school education in terms of apprenticeship at its best. Influential labor leaders have, during the past decade, recommended the gradual elimination of all pre-employment training in the public school system. The real function of the public industrial school, says labor, is to provide supplemental instruction for employed workers apprentices, as well as journeymen. Regular supplemental instruction in the school is required to complete labor's current definition of the new industrial apprenticeship.

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# RURAL COMMUNICATION PATTERNS: A STUDY IN THE AVAILABILITY AND USE OF PRINT, RADIO AND FILM IN SHELBY COUNTY, MISSOURI

(Publication No. 1281)\*

Howard Rusk Long, Ph.D. University of Missouri, 1948

The purpose of the present study is to investigate the availability and use of print, radio and motion picture film among rural people, and the factors that determine the acceptance or rejection of these media. Factors included are place of residence, economic status, education, sex and age.

Shelby County, as fairly representative of the rural Missouri counties, was selected as the setting. The availability of communications media was measured, first, by an inventory of a sample of 10 per cent of the households distributed proportionally in the villages and open country of the nine townships, and second, by an analysis of data obtained from agencies that control the media. A third type of information includes behavior of Shelby County people in relation to the various communications media. These data were obtained along with the household data. Additional information was obtained from the records of the schools, libraries, newspapers, motion picture theatres, mercantile establishments and through interviews with the persons in charge.

One of the most obvious observations to be drawn from the data of the present study is that so few of the facilities of indirect communication available to Shelby Countians are of local origin. Only the local weekly newspapers and a few items of miscellaneous printed matter are produced expressly for Shelby Countians. The content of print, radio and film, with the exception of the material printed locally, the agricultural publications, and the few farm radio programs, seems to be directed toward the interests of urban audiences. Daily newspapers reach 75 per cent of the households, periodicals 80 per cent of the households, books and local weekly newspapers were found in 95 per cent of the households. Radio sets were found in 86 per cent of the households, but listening was limited largely to four stations.

All media were more readily available in village households than

<sup>\*</sup> Microfilm copy of complete manuscript of 396 pages, \$4.95. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-81.

in open country households. These are significant correlations between economic status and the availability of daily newspapers, the availability of periodicals and the number of books owned in the household. Education likewise was a significant factor in the use of indirect media. Greatest reading activity takes place in the schoolage groups and among persons past 60 years of age. Movie attendance is highest in the 10-19 age groups and declines thereafter with each ten-year interval. Women read more books than men and attend the movies more frequently.

Reading is limited largely to the content of newspapers, periodicals and books that appeal to the emotions. Radio programs classified as news broadcasts, variety programs and serial stories account for the bulk of the listening. The most popular motion pictures in Shelby County are those with a bucolic theme; least popular are the pictures that appeal to more sophisticated audiences.

The data seem to indicate that persons who use one medium of indirect communication tend also to use the others. On the other hand, from 10 to 15 per cent of the households, on the lower end of the economic scale, make little, if any, use of print, radio and film. The world of these people seems restricted to the primary group.

### THE IMMORTAL PILGRIM: AN ETHICAL INTERPRETATION OF HAWTHORNE'S FICTION

(Publication No. 1182)\*

Aaron Darrel Abel, Ph. D. University of Michigan, 1949

In Hawthorne's fiction, "Art becomes the interpreter of something profounder than herself" — the world of moral realities. In general, Hawthorne accepted Transcedentalist assumptions but criticized them from a Calvinist point of view. He believed in an ideal world transcending the real, but insisted that, since human life was a pilgrimage through the material world, man's immediate concerns were the mundane satisfactions and moral perils of his pilgrimage. He believed in man's intuition of and aspiration toward the transcendent world, but regarded man as being feeble in will and prone to evil. He pictured man's life as a struggle to realize the best elements of his nature.

The changing aspects under which Hawthorne viewed this struggle reflect the changing circumstances of his own experience. The tales and sketches written or conceived during his years of seclusion constitute the first phase of his consideration of the problem of evil. They are introspective studies of evil as it appears in the consciousness of individuals oftener succumbing to or suffering than doing evil. They show persons isolated from natural and spiritual community, and thus denied the full self-realization they aspire to, either through their own waywardness of inadequacy or through some unfavorable conjunction of outer circumstances.

The wider experience of life which came with his marriage, his work at varied tasks in the world, and his Brook Farm sojourn, resulted in Hawthorne's looking at the problem of evil more experimentally and less introspectively. His awareness of the problem broadened, so that his three American romances — The Scarlet Letter, The House of the Seven Gables, and The Blithedale Romance—exhibit evil, not merely as manifested in individual consciousness, but in intimate personal relationships. The Scarlet Letter shows how a person's evil-doing inevitably affects the moral welfare of other persons associated with him, whether sharers of his guilt or not; it views a typical sin from several points of view, and apparently

<sup>\*</sup> Microfilm copy of complete manuscript of 384 pages, \$4.80. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-391.

rejects the ethics of romantic individualism, of determinism, and of legalism, to demonstrate the validity of pietistic ethics. The House of the Seven Gables and The Blithedale Romance are complementary treatments of the theme that traditional and utopian attitudes toward social conventions and institutions are good when they cooperate, bad when they are in extreme opposition. In cooperation, they give more perfect form to "the institutions that have grown out of the heart of mankind"; in opposition, Tradition strives to preserve vicious and decadent as well as vital forms, and Utopia discards sacred and vital things to attempt narrow and impractical projects.

Hawthorne's foreign residence made him aware of the relativity of the moral values embodied in any system of society. Noting the great difference between the moral systems of Italy and America, he recognized the appropriateness of both to their different sets of native conditions, and hesitated to declare the absolute superiority of either. He sought to rise above the relative ethics based upon a mere national, or even mundane, view of things. Unable to find an accessible ethical absolute, and unsatisfied with either the substitute for ethical life offered in art or the abdication of ethical life involved in merely materialistic belief, he assumed that man's life had meaning in a realm of value inaccessible to human investigation, and adopted a stoic detachment.

### THE FRENCH REVOLUTION AND THE AMERICAN MAN OF LETTERS

(Publication No. 1222)\*

Esther E. Brown, Ph. D. University of Missouri, 1948

This study deals with the reaction to the French Revolution of six eighteenth-century American men of letters: Thomas Jefferson, John Adams, Joel Barlow, Noah Webster, Timothy Dwight, and Philip Freneau. All six were patriots of the American Revolution. Jefferson resided in France (1784-1789) and was horrified by the suffering of the French poor. Adams was also in France (1778-1785) but was less struck by the misery of the lower classes than by what he considered general French immorality. Barlow, after a Connecticut

<sup>\*</sup> Microfilm copy of complete manuscript of 336 pages, \$4.14. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-22.

upbringing, arrived in France in 1788 and came under the influence of French intellectuals. Webster was attracted by radical political philosophy but was cooled by the advice of conservative associates. Dwight, a strict Calvinist, learned to judge everything by the standards of Connecticut. Freneau was inclined to favor France because of his French blood and his hatred of England; also he had expoused the cause of the common man. The reactions of the six men to the French Revolution must be considered in the light of these earlier experiences and attitudes.

The six adhered in varying degrees to principles fundamental to both the American and the French Revolutions: (1) equality, (2) natural rights, (3) popular sovereignty, (4) the idea of progress. In general Jefferson and Freneau advocated these ideas most strongly. Barlow had not formulated his political creed by 1789, though his tendencies were liberal. Webster was generally favorable to these doctrines, but doubted whether they could be applied in Europe. Adams was shifting away from his early revolutionary enthusiasm. Dwight's view was generally conservative, though he attacked slavery. Analysis of the attitudes of the six men toward these basic revolutionary doctrines reveals that all professed certain democratic ideals associated with the American Revolution. How well these attitudes would weather the storms of the French Revolution remained to be seen.

Jefferson gave graphic accounts of the French Revolution until his departure from France (October, 1789). He hoped that France might become a constitutional monarchy like England. The enthusiasm aroused in America by the French Revolution was reflected by Freneau and (at first) by Webster. Dwight appeared for some time non-committal and uninterested. Adams was suspicious from the outset. Barlow, while in France and England, was a propagandist for the French Revolution and was made a citizen of France. His notes for a history of the French Revolution (1797) reflect disillusion with its practices but not its principles. In America Jefferson continued to champion France and its revolution.

To Jefferson, as to many American democrats, the success of republicanism in America long seemed dependent upon the success of the French Revolution. Jefferson was assisted in his promotion of republican doctrines by Freneau, who edited the democratic, pro-French National Gazette and other newspapers. Jefferson, Freneau, and their party were opposed by Adams, a strong Federalist, by Webster, who edited the Federalist Minerva, and by Dwight, who regarded the French Revolution as a device of Antichrist and Jefferson's party as an American "fifth column" in favor French infidelity. When the policy of President Adams seemed to be bringing America close to war with France, Barlow intervened in an effort to avert

hostilities. The Genet and XYZ affairs abated popular enthusiasm for France but the Federalist party had over-reached itself and was doomed.

The conclusions of this study relate to two questions: (1) the extent to which the various men of letters were able to preserve their liberal convictions amid external pressures; (2) the effect of the French Revolution in increasing the isolationism of nineteenth-century America. Jefferson, Barlow, and Freneau, though disillusioned with the outcome of the French Revolution (especially with Napoleonic imperialism), did not lose faith in democratic ideals. Adams, after 1800, gradually returned to more liberal ideas, but never ceased to blame the French Revolution for the ills of Europe and for his own unpopularity. Webster and Dwight became frightened reactionaries. All parties united in willingness to slam the door on Europe: the liberals because they were disillusioned with the bloodshed and renewed tyranny in Europe; the conservatives because they feared the contagion of "French ideas" in religion as well as in politics.

### THE IDEAS OF JOHN JAY CHAPMAN

(Publication No. 1261)\*

David Mackenzie Stocking, Ph. D. University of Michigan, 1949

John Jay Chapman (1862-1933) is an American critic who has been both neglected and misunderstood. Chapman's published writings, frequently unorganized and containing apparent contradictions, suggest a position, but make no coherent statement of it. This study therefore attempts to clarify misconceptions about Chapman's thought and to suggest its worth, by defining and evaluating his leading ideas. Part I deals in two chapters with Chapman's philosophical position. Chapter I discusses the idealistic humanitarianism which Chapman developed to support his program of political reform. This position was mainly a theory of human nature, which embraced two incompatible forms of determinism. It became untenable even for Chapman, when he questioned his idea of man's innate goodness. Shortly thereafter, a nervous breakdown temporarily shattered his life and thought in mid-carreer. Chapter II outlines the general

<sup>\*</sup> Microfilm copy of complete manuscript of 310 pages, \$3.88. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-61.

position which pervaded Chapman's writing after his recovery from the illness. This position was grounded in mystical experience, and was characterized by a skeptical rejection of all organized intellectual formulation, whether theological, philosophical, or scientific. It relied upon impulse, which represented the play of transcendental force upon man, force to which man can respond only when passive, un-self-conscious, non-analytical. Protecting the irrationalistic elements of this position from the dangers of sentimental of vicious ignorance, a humanistic view of education complemented Chapman's transcendentalism: only after one has so thoroughly absorbed the masterpieces of art that their wisdom permeates his being, it impulse reliable. For art is the only human medium for the communication of ultimate truth.

Part II discusses the esthetic implications of Chapman's thought. It treats briefly his early esthetic ideas, which encountered the same difficulties that plagued his early philosophy; it discusses particularly his later ideas of art, which brought his position to its richest development. Chapter III presents his view of criticism, which reveals his conviction that the values of art are incommensurate with any intellectual formulation of them by the critic, and emphasizes the futility of much second-rate criticism and teaching. Chapter IV analyses his conception of greatness in art, formulating more completely his conviction that art, because of its indirection, is the only "language" for communicating ultimate truth. Art can symbolize reality because it employs, not realities, but illusions, artificially selected and arranged. Chapter V outlines Chapman's conception of the artist. Ideally, he is the passive recipient of transcendental forces which pass through him into his art. He senses the limitations of his medium because aware of the great traditions of art; he achieves an organic relation to his culture by active participation in the life of his epoch; and he is nurtured by that epoch when it provides a climate favorable to art. The Conclusion of this study relates Chapman's ideas to a central concept, Creative Force, and suggests the limitations and strength of Chapman's approach to art and life. It asserts that, contrary to frequent interpretation, his later position is far superior to the confused brilliance of his earlier thought, especially for its dialectical reconciliation of romantic and humanistic interpretations of life.

### A COMMENTARY ON BYRON'S DON JUAN, CANTOS VII - X

(Publication No. 1178)\*

Frank Stiling, Ph. D. University of Michigan, 1949

This dissertation comprises two parts: the introduction and the commentary. The latter includes the text of Cantos VII to X, quotations from Byron's reading, explication of those parts of the text difficult of comprehension, and notes about the imagery and structure. The introduction places these cantos in their proper setting, and derived from their study.

Byron's choice of the Russian material in Don Juan has been attributed to artistic and political reasons. For a successful satire on war and tyranny, the poet needed a military action and a royal court, both sufficiently remote to be detached from the emotions of English readers. As Juan was to perish in revolutionary France, the choice of battles was chronologically limited to Russia's war with Turkey in 1790-92. Since Juan had been left at Constantinople in Canto VI, the campaign in Moldavia suited the poem geographically. The political reasons, more important than the artistic, arose from Byron's feelings about the effects of Russia's foreign policy upon Italy and Greece.

The lifeless presentation of Catherine is to be explained by artistic and psychological difficulties. Byron could not have shown her greatness or sensuality without defeating his satiric purpose. On the other hand, because of his personal admiration for her and because of his imaginative association of Lady Oxford with her, he would not caricature her. Consequently, despite the ribaldry, Catherine appears as a dignified marionette.

The selection and modification of source material have been determined by Byron's satiric and poetic purposes. Frequently in VII and VIII, he has followed Castelnau's historical work, but occasionally in them and consistently in Cantos IX and X, he has assimilated the material and created original poetry. Special notice has been taken of the places where he has appeared to adhere to the sources, but where he has actually introduced many changes which enrich the imagery and emotion or serve his satiric purpose.

With Canto VII important changes in the poem begin: (1) The

<sup>\*</sup> Microfilm copy of complete manuscript of 590 pages, \$7.38. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-387.

alternation of amatory incident and travel abandoned temporarily in VII and VIII, and finally after X. (2) The narrative becomes increasingly satirical. (3) Canto VII has rigid unity, which is relaxed in VIII and abandoned in IX.

Canto VII suffers from the restraint imposed by the formal unity; VII and VIII by too close adherence to historical sources.

As Don Juan is unique, its design cannot be judged by that of traditional literary forms like the classical satire or epic. The loose structure is a satiric one of which both narrative and digressions are components. In the context, the latter usually have associations with the narrative, expressed in modulating verses. Most digressions in VII and VIII are related to the specific satiric themes of the cantos, but in IX and X they are not so limited because they reflect the complex purpose of the poem, the exposure of man's insincerity in human relations.

Canto IX is important in the structure of the whole poem because it contains the climax of the satiric pattern. Love, war, glory, and tyranny are concentrated in Catherine. Henceforth, war and martial glory receive only incidental attention; love is never again commended; but tyranny is still attacked.

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## A STUDY OF THE OLD-FRENCH ARTHURIAN ROMANCE DURMART LE GALOIS

(Publication No. 1265)\*

Joseph James Gildea, Ph. D. University of Pennsylvania, 1946

This anonymous romance, published in 1873 by Edmund Stengel, is extant on only one manuscript, Bern 113. The dissertation includes a description of the manuscript and its other contents, together with publication data. A summary of the poem is given and the questions of sources, literary influence, language, date, and composition are examined in an effort to supplement and confirm or rectify previous studies and discussions.

There are only tenuous indications that the poem is a reworking of an earlier version of the story, which recounts the hero's quest for the beautiful Queen of Ireland, known to him only through hearsay. It is unlikely that the source is to be sought in the biography of the Provençal troubadour, Jaufré Rudel. No positive evidence exists to show that a Durmart legend existed. There is, however, some reason to believe that traces of such a legend survive in the Arthurian bas-relief on the archivolt over the north portal of the Cathedral at Modena. The name Burmaltus which figures in the inscriptions on the archivolt is taken to refer to one of the knights, and not to the peasant, as some critics have maintained. By allowing for corruption of the name and identifying the knight with Durmart, the Modena archivolt and the Durmart version of Guenevere's abduction may be taken to represent cognate traditions. Although some elements of plausibility favor the contention of Ernst Brugger that the Durmart is a version of the Desconeu type of romance, which he believes includes most of the Arthurian romans biographiques known to us, the evidence so far presented by Brugger cannot be considered compelling. In any case, the direct source for the Durmart which is postulated according to this theory must remain unidentified.

The poem is dependent for certain themes on Chrétien's Conte del graal and the continuations of that work by Pseudo-Wauchier and Wauchier. Evidence that has been adduced to establish dependence on Meraugis de Portlesguez by Raoul de Houdenc, the Bel Inconnu by Renaut de Beaujeu, and the Yder, is insufficient.

<sup>\*</sup> Microfilm copy of complete manuscript of 150 pages, \$1.88. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-65.

Dependent on the Durmart are the <u>Garin de Monglane</u>, the <u>Chevalier as deus espees</u>, the <u>Atre perilleux</u>, and the <u>Claris et Laris</u>.

Analysis of forms attested by the rimes and syllable count shows that the author was from the Picard region but was markedly influenced by the Franco-Picard literary koiné. The Picard traits that were adopted into this koiné occur with significant frequency and consistency. There are, moreover, numerous other picardisms that can be certified and that make it reasonably certain that the author was from Picardy.

Despite conservatism in declension and inflection (which in a Picard text is not especially revealing), the frequency of hybrid Franco-Picard rimes and of rimes showing <u>iee>ie</u> speaks against a twelfth century date for the poem. Mention of Glastonbury as one of the seats of Arthur's court also excludes the possibility of such an early date. Other internal evidence indicates a <u>terminus ad quem</u> of 1244. This cannot be set any earlier through external evidence supplied by literary relationships. On the other hand, there is no evidence pointing to a <u>terminus a quo</u> later than the early years of the thirteenth century.

Analysis of the careful composition of the <u>Durmart</u> and of its other literary qualities substantiates the favorable impression which has led critics to accord it a distinguished place among the romances. Although traditional themes and motifs, bereft of mystifying elements, are employed, they are handled deftly and are blended into a purposeful, well-constructed tale of high moral tone.

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### THE EDUCATIONAL IDEAL IN THE MAJOR WORKS OF HERMANN HESSE

(Publication No. 1186)\*

Clarence Boersma, Ph. D. University of Michigan, 1949

For the German-Swiss Hermann Hesse, (b. 1877) winner of the Nobel Prize for Literature in 1946, education, in the sense of the German "Erziehung", has been a pivotal problem. The purpose of this study is to discover the basic line of his thought as it deals with the education of man. The results of this investigation may be summarized briefly as follows:

Motivated alike by his own bitter experiences as a schoolboy and by his observations of the moral impotence of the contemporary European, Hesse's major works - i.e., his novels and shorter works in prose after 1917 - thoroughly criticize existing education and emphasize the dire need for a complete re-education of occidental man. In an early, largely autobiographical novel, Unterm Rad (1906), Hesse crusades against German educators and berates them for the tragic results of the unimaginative, over-intellectual scholarship imposed upon adolescent boys. With less personal animus and a more intense spiritual power, Hesse continues to criticize education in his literary work after the first World War. The same fundamental faults are emphasized: over-intellectuality and the failure to recognize the needs peculiar to the child and adolescent the failure especially to give proper consideration to the subconscious, "irrational" drives in human nature. The failure of parents and teachers to disclose to youth the absolute requirements of the moral nature of man is likewise protested.

Intimately bound up with Hesse's educational ideal is a Weltanschauung which conceives of the universe as a harmonious unity. The experience of this harmony and oneness is not achieved by occidental, logical analysis, but rather by the spell of art and by methods of oriental philosophy and religion — especially that of the Hindu Yogi. The serene abandonment of the Individual to this All is the summum bonum to be sought by mankind.

Western man is urged to desist from his futile technological attempts at circumventing a Fate which he imagines to be an

<sup>\*</sup> Microfilm copy of complete manuscript of 314 pages, \$3.93. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-395.

inimical outer force against which he must struggle to survive. In contrast, Hesse exalts the ideal of an inner, spiritual culture. Man's salvation lies on the "Weg nach Innen". When an individual by honest effort makes the discovery of his true self, his "eigenen Sinn", then he "awakens" — he finds that Fate is not outside him in the delusive Maya of common sense, but rather that Fate is his deepest self, whose promptings, having the force of divine, unalterable Law, are gladly heeded.

Essentially, each must find this harmony for himself. Words and concepts are incapable of communicating the self-knowledge requisite for inner harmony. However, by sympathetic leadership on the part of one who has achieved this spirituality, an atmosphere that predisposes others to such spiritual rebirth can be created. Such an atmosphere is one charged with humor, with play, with art.

Outstanding among the literary influences in the development of Hermann Hesse's ideas are the classic writers of India and China, Goethe, Nietzsche, Burckhardt, Dostoyevsky, and Novalis.

### THE LIFE AND WORKS OF JUAN DE DIOS PEZA

(Publication No. 1275)\*

Herbert Logan Cobb, Ph. D. University of Missouri, 1947

This study was undertaken in order to (1) assemble as many pertinent biographical details about Juan de Dios Peza as could be collected from the numerous brief accounts given by critics and anthologists and gleaned from the poet's own writings; (2) call attention to the factors and characteristics that made Peza popular during his lifetime, and to the qualities in his writings that constitute universality of appeal; (3) indicate Peza's place in Mexican literature on the basis of criticism and an analysis of salient and representative compositions chosen from his published works.

Juan de Dios Peza was born in Mexico City in 1852, and died there in 1910. Even as a boy he was known among his friends for his ability to write verse easily. He received a thorough education. The fact that it was imbued with tolerance is of considerable importance, for Peza developed liberal tendencies, whereas his father was a conservative and a member of Maximilian's cabinet. Fortunately, the elder Peza was willing for his son to think independently. Abandoning his medical studies in order to earn a living because of financial difficulties at home, Peza turned to journalism. During the decade ending in 1877 he became a popular poet and was the bard at public festivities. This popularity facilitated his entrance into a diplomatic career, and resulted in his appointment as second secretary of the Mexican Legation in Madrid in 1878. His sojourn in Spain was extremely important for him, because while associating with the literary people of the Villa y Corte he asserted and purified his style. During this period Peza also strengthened the literary relations between Mexico and Spain by making the Mexican poets of his day known in the mother country through his La lira mexicana, an anthology, and articles that he contributed to periodicals.

Peza did not attain the highest development of his poetic art until after the domestic tragedy of his life, which occurred a few years after his return to Mexico. Sadness, always a dominant element in Peza's life, reached its depth in this misfortune, and,

<sup>\*</sup> Microfilm copy of complete manuscript of 191 pages, \$2.39. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-75.

conversely, the poet, his zenith in poetic productions. Peza's three motherless children inspired the outpouring of their father's soul in poetry that has universality of appeal. Distinguished critics have assigned Peza a place in the realm of hogar poetry that is not rivalled by that of any other poet in the Spanish language. At this point in his career Peza assumed a style and a manner all his own. One critic has credited him with starting a new genre, and, therefore, with being a real artist — a creator.

Peza's patriotic poetry ranks next in importance to his hogar compositions. Growing up with the rebirth of literary interests in Mexico following the dissolution of the Empire under Maximilian, Peza identified himself with the important changes in government and letters. His own being and imagination were so animated by the heroic exploits of his countrymen that he sought, through his poetry, to awaken in the people's hearts the fervent love of Liberty, Independence, and Reform which their forebears had demonstrated in securing independence and which would continue to be needed to accomplish the ultimate goal of national unity. In addition to lauding the leaders and their deeds, Peza sought to give the point of view of the Indian. His idea was that national unity could not be achieved without the complete fusion of the Indian and Spanish cultures. The Indian should not merely have a foreign civilization imposed upon him. The best features of the two cultures should be molded into one.

Peza's minor works, consisting of theatrical productions and prose, make pleasant reading and corroborate many of the ideas expressed in his poetry. In mood and tone they are definitely akin to his greatest poetry.

Critics vary in their estimates of Peza, but the consensus of opinion is that he was an inspired poet who did marvelous things with everyday topics and has made them live forever.

## A TOPOLOGICAL STUDY OF THE LEVEL CURVES OF HARMONIC FUNCTIONS

(Publication No. 1235)\*

William Munger Boothby, Ph. D. University of Michigan, 1949

W. Kaplan has studied the properties of curve families F filling an open, simply-connected domain D of the xy-plane which have the property of regularity (a curve family is said to be regular in a domain D if at every point of D it is locally homeomorphic to parallel lines). With respect to such families he has proved the following theorems: (1) for any curve family F filling D there exists a decomposition of F into non-overlapping subfamilies, each homeomorphic to the family of lines y = constant filling the upper half of the xyplane; (2) there exists a continuous function f(x, y) without relative extrema defined on D such that the level curves f(x, y) = constant are precisely the curves of F; (3) there exists a homeomorphism (x, y)↔(x', y') €D', from D onto D', where D' is either the finite plane or the interior of the unit circle, with the property that the function f'(x', y') = f(x, y) for (x', y') corresponding to (x, y) is <u>harmonic</u> in D', and has of course, the family F', image of F, as level curves; and, finally (4) there exists a homeomorphism of D onto a domain D carrying F onto F, a family of curves filling D and defined by the differential equations:

$$\frac{dx}{dt} = g(x, y); \frac{dy}{dt} = h(x, y).$$

This dissertation generalizes F to a curve family regular in a simply-connected domain D except at an isolated set B of singular points at each of which the curve family has a singularity of the multiple saddle point type. It is shown that for this more general curve family, theorems (2), (3), and (4) hold without modification. Theorem (1) holds with the following slight change: sets of the decomposition may intersect, but only at points of their "initial" curves, where by an initial curve is meant the inverse image of the x-axis in the homeomorphism of the decomposition set onto the upper half of the xy-plane.

As in Kaplan's work, theorems (1) and (3) have the following

<sup>\*</sup> Microfilm copy of complete manuscript of 91 pages, \$1.14. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-35.

significance: (3) characterizes (up to homeomorphism) the level curves of a harmonic function by purely local topological conditions, since it is well-known that functions harmonic in a simply-connected domain have level curve families of the type described, whereas, this theorem proves the converse; (1) on the other hand, when applied to the level curves of the real part of an entire function, furnishes a decomposition of the Riemann surface of the inverse function into simply-connected fundamental domains.

The essential technique used in the proofs of (1) - (3) was to slit the multiply-connected domain D-B along curves of F in such a fashion as to make the "slit" domain D\* simply-connected. There remains a subfamily F\* of F in D\* to which the corresponding theorems of Kaplan may be applied; then, after suitable modification near the boundary of D\* the curves removed in the slitting operation may be replaced, and the functions (or decomposition in (1) may be extended to include all of D. (4) is a trivial corollary to (3).

## SAMPLE CRITERIA FOR TESTING OUTLYING OBSERVATIONS (Publication No. 1244)\*

Frank Ephraim Grubbs, Ph. D. University of Michigan, 1949

The problem of testing outlying observations, although an old one, is of considerable importance in the field of applied statistics. Many and various types of significance tests have been proposed by investigators interested in this field of application. A summary of previous work on testing the significance of outlying observations is given in the Historical Comments of this thesis and notable advances toward a clear formulation of the problem including important points which should be considered in attempting a complete solution are given. The situations which the experimental statistician will very likely encounter in practice are outlined, these considerations being based on experience, and a systematic treatment of points which should be considered in setting up statistical hypotheses to be tested is given including the determination of appropriate sample criteria which provide efficient or best tests in the sense of Neyman-Pearson. Efficient tests for outlying observations appear to be based on (1) the sum of squares about the mean

<sup>\*</sup> Microfilm copy of complete manuscript of 71 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-44.

of all the observations in the sample and (2) the sum of squares about the mean of only the observations in the sample which appear consistent with one another. In case an accurate estimate of population standard deviation is available, for example, from past experience, it is shown that efficient tests should be based on the difference between (1) and (2). On the other hand, for an exact and efficient test in the case where no knowledge of the standard deviation is available efficient sample criteria should be based on the ratio of (2) to (1). In the case of a single outlying observation, the standard deviation o assumed known, the best sample statistic consists of the difference between the extreme observation and the sample mean. The probability distribution of this statistic is derived and its probability integral is tabulated in this dissertation. It is apparent that the set of functions necessary for tabulating the probability integral of the difference between the extreme observation and sample mean may prove of considerable use in Mathematical Statistics - probably in the field of order statistics. The set of functions referred to have been tabulated on a high-speed electronic computing device, the Electronic Numerical Integrator and Computor (ENIAC), at the Ballistic Research Laboratories. For the case in which the population standard deviation is unknown exact distributions for efficient sample criteria are derived for testing either the largest or the smallest observation in the sample and the two largest or two smallest observations in the sample. The distribution of the sample statistic for testing the significance of either the largest or the smallest observation have been tabulated on the Bell Relay Computor at the Ballistic Research Laboratories. The dissertation is concluded with applications of the theory to several examples and some useful methods of attack in testing outlying observations in practice are given.

#### RENAL LIPIDOSIS

(Publication No. 1258)\*

Hilton Atmore Smith, Ph. D. University of Michigan, 1949

SUMMARY of a thesis on RENAL LIPIDOSIS presented by Hilton Atmore Smith in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the University of Michigan, 1949.

The occurrence of renal lipidosis was studied in man and animals. Two hundred eighty-eight cases of moderate or severe renal lipidosis were selected from 10,000 autopsies and the relative degree of deposition of fat, its location in the nephron or other histological structures and in the individual cell were determined. Correlations were made with associated diseases, with lipidosis in the liver, heart and adrenal, with the presence or absence of obesity, emaciation, and some other features of a minor nature.

Ninety-five cases of clinical disease in domestic animals were examined for renal lipidosis and studied in a similar manner. Experimentally attempts were made to produce renal lipidosis in dogs by the administration of certain poisons and by asphyxiation.

Results of the study indicated the following: Renal lipidosis of humans occurred predominantly in conjunction with (1) nephrosclerotic or glomerular renal disease, (2) arteriosclerotic disease of kidneys, heart or encephalon, and (3) diabetes. Tuberculosis, infectious pyelonephritis and pyogenic infections in general showed a negative correlation. Pneumonia was perplexingly variable in its correlation with renal lipidosis.

In animals much the same types of disease accompanied renal lipidosis as in man but a variety of other conditions also were associated with it, such as cancers, paralyses and other nervous diseases, and pyogenic processes to the extent of about one-half of the cases in this last group.

Poisoning by phosphorus, alpha-naphthyl-thio-urea, and the cockle-bur plant (Xanthium sp.) regularly produced renal lipidosis. Suffocation produced it when prolonged for several hours.

Obesity of the patient favored the occurrence of renal lipidosis. Emaciation and cachexia had no effect.

<sup>\*</sup> Microfilm copy of complete manuscript of 305 pages, \$3.82. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-58.

Renal, hepatic, and cardiac lipidosis often occurred together but indications were that the three conditions were independent of each other and depended upon suitable causative conditions being present in the organ affected.

Analysis of the associated conditions pointed to general or local anoxia as a feature common to practically all of the human diseases and many of those in animals. Results of experimental asphyxiation supported the view that anoxia was the basic cause of renal lipidosis in these diseases.

However, there was no doubt of the ability of the three poisons mentioned to induce renal lipidosis, and, in all probability, there are other poisons which behave similarly. That the underlying action of these poisons is to institute a state of local anoxia is a reasonable speculation.

Local damage and destruction of cells, such as occurs in chronic nephritis, amyloidosis, infarction, and similar conditions was observed repeatedly in close proximity and intimate relationship to areas of renal lipidosis. These destructive changes may also have owed their effect to local anoxia but the possibility must be considered that the lipids seen in living cells were merely imbibed from the surrounding medium, which had become saturated with fat released from disintegrating cells in the area.

It has not been possible to adopt the view that visible renal fat is normal, or that such fat is in the process of excretion with the urine.

## SOME HUMORAL ASPECTS OF HEPATIC CIRRHOSIS IN THE MALE. A MORPHOLOGIC STUDY

(Publication No. 1237)\*

Henry Clay Bryant, Ph. D. University of Michigan, 1949

The humoral aspects of hepatic cirrhosis in the male have been dealt with in the past, primarily from physiologic and endocrinologic points of view. The presence of a hormonal imbalance in the advanced stages of this disease has been discussed by Italian pathologists and internists. The observers have recognized the morphologic manifestations of this endocrine disturbance by the association

<sup>\*</sup> Microfilm copy of complete manuscript of 145 pages, \$1.83. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-37.

of gynecomastia and testicular atrophy with Laennec's cirrhosis. They have designated this complex as the Silvestrini-Corda syndrome. In evaluating the morphologic manifestations of this disease, approximately 11,000 autopsies in the series at the University of Michigan have been screened, and the microscopical sections reviewed whenever it seemed to be indicated. Sixty-four cases of hepatic cirrhosis have been culled from this material and studied in detail.

The histologic changes in the testes of patients with advanced hepatic disease are not specific for this disease per se, but are specific for the general group of systemic diseases and humoral abnormalities to which hepatic cirrhosis belongs. Histologic similarities are apparent between the Sertoli cells in this disease and the descriptions in the literature of estrogen-producing Sertoli cell tumors in dogs, and with the Sertoli cells in the testes of some human pseudohermaphrodites. This leads to the hypothesis that in some patients with hepatic cirrhosis, the Sertoli cells may be a source of estrogen.

Prior to the terminal stage of chronic hepatic disease, the Leydig cells contain an increased amount of stainable lipid material. The majority of these patients have a reduction in the urinary 17-ketosteroid concentration, and there is no consistent picture with reference to the lipid content of the adrenal cortex. It must be assumed that this change in the Leydig cells represents either degenerative fatty infiltration, or retention of the androgenic hormone.

The humoral manifestations of hepatic disease are inseparably related to the nutritonal status of the patient. The morphologic changes in the breast, testes, bone, and skin of patients with malnutrition are closely similar and, in many instances, identical to those associated with hepatic cirrhosis. After evaluating the morphologic visceral changes in the control series and various phases of hepatic disease, it has been concluded that the degree of the anatomic manifestations of the humoral disturbances associated with hepatic cirrhosis depends upon transient retrogressive changes in the liver which represent a part of the natural history of the disease, and upon the conditions discussed in the control series which are frequently present as complications. The quantitative expression of the morphologic manifestations and the fact that they occur in some patients and not in others depends also upon the constitutional type of the individual.

# CYTOLOGICAL PHENOMENA OBSERVED DURING SELECTIVE AND NONSELECTIVE INJURY TO MALIGNANT CELLS IN TISSUE CULTURE WITH PENICILLIUM EXTRACTS AND WITH NITROGEN MUSTARDS

(Publication No. 1241)\*

Ivor Cornman, Ph. D. University of Michigan, 1949

This research was undertaken for the dual purpose of discovering whether cancer-damaging substances can be detected by means of tissue culture, and whether such damage can be quantitatively evaluated so as to reveal a difference in effects upon normal and malignant tissues.

Normal and malignant tissues were grown together in rollertube cultures and thus were exposed simultaneously to the substance under test. Rat sarcomas were grown with fetal rat muscle fibroblasts and mouse sarcomas and carcinomas with epithelium and fibroblasts from fetal mouse skin.

In the first series of experiments, the cultures were repeatedly dosed with crude penicillin, the dose being adjusted according to the visible damage. It was possible to kill the malignant cells (as judged by visible damage and by bioassay) without killing the fibroblasts (subsequent proliferation in culture).

In the second series numerical values were assigned to the amount of damage shown by the cells and the percentage of cells damaged, then the difference between the treated malignant and normal tissues was compared with the difference between the untreated normal and malignant. The substances tested were crude penicillins, filtrates from Penicillium cultures, and five nitrogen mustards: methyl bis- $(\beta$ -chloroethyl)-amine, tris- $(\beta$ -chloroethyl)-amine, bis- $[bis-(\beta$ -chloroethyl)-amino]-ethane, 1,3-bis- $[bis-(\beta$ -chloroethyl)-amino]-propane, and 2-chloro-1,3-bis- $[bis-(\beta$ -chloroethyl)-amino]-propane.

This method also revealed that Penicillium gives off one or more substances which selectively damage malignant cells. The nitrogen mustards were equally toxic to normal and malignant cells, with the exception of Sarcoma 180, which reacted to concentrations 1/10 those required to damage other cells.

<sup>\*</sup> Microfilm copy of complete manuscript of 79 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-41.

This demonstrates the value of tissue culture in sorting substances for anticancer effects. The system of evaluating damage makes possible an efficient screening of large numbers of substances. Not all substances of possible therapeutic value will be uncovered by this method, however. The nitrogen mustards, already demonstrated clinically to have a retarding effect on neoplasms, showed no significant selective effect in vitro.

## AGE, KIDNEY RENIN AND FACTORS INFLUENCING PRESSOR ASSAY

(Publication No. 1285)\*

Gustav Carl Rau, Ph. D. University of Missouri, 1948

Existing studies of renin, particularly those based on assay evaluation present many conflicting findings. Various of the current methods of renin assay have been checked experimentally and certain procedures established as physiologically sound. The regimen thus obtained was then applied to the study of the relation of age to renin production. Renins prepared from hog kidneys and from the kidneys of rabbits of various ages were assayed as hypertensin.

Factors affecting the validity of these assays, such as anesthetics, assay animals, hypertensinogen solutions, anticoagulants and intravenous injections are discussed.

Renin prepared from kidneys of rabbits of three age groups, namely 20-24 days, 180 days and 365 days of age, was assayed on cats. The renin yield was essentially the same for the two lower age groups and approximately five times that of the adult rabbits. Correlation of the renin yield from the rabbits of the three age groups with the mean systolic blood pressures showed that the animals of the two groups having the high renin yield had not attained full adult systolic blood pressure. The relations of renin yield to age and to hypertension are discussed.

<sup>\*</sup> Microfilm copy of complete manuscript of 145 pages, \$1.82. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-85.

## STUDIES ON ANALGESIA: ANALYSIS OF ALGESIMETRIC METHODS AND THE EVALUATION OF 1-METHYL-4-(3-HYDROXYPHENYL)-4-PIPERIDYL ETHYL KETONE

(Publication No. 1204)\*

John Reed Lewis, Ph. D. University of Michigan, 1949

Several methods using a radiant thermal stimulus with albino rats as the experimental animals were investigated for their applicability as screening methods for testing compounds for analgesic activity. The one, found to be most suitable in our hands consisted of stimulating a shaved area of a rat's back and determining the time of reaction for a muscle twitch of the back.

1-Methyl-4-(3-hydroxyphenyl)-4-piperidyl ethyl ketone hydrochloride (WIN 1539) was found to have analgesic activity about five times that of morphine and ten times that of Demerol.

The analgesia produced by WIN 1539 was potentiated by pilocarpine, eserine and epinephrine. This action was similar to that of morphine.

WIN 1539 produces excitation in cats which is indistinguishable from this action of morphine.

WIN 1539 was found to have a stronger spasmolytic action than Demerol on the stimulated isolated intestinal strip. A decrease in tone of the intact small intestine of the dog was observed. WIN 1539 caused a greater delay than Demerol in the emptying time of the rat's stomach but morphine retarded emptying more than either of these drugs. Demerol caused a stimulation of the intact rat's stomach whereas WIN 1539 and morphine decreased the motility of this organ.

Tolerance developed to the analgesic action of WIN 1539, when administered daily to rats, at a rate and to a degree comparable to that of morphine. The recovery from the tolerance was not as rapid with WIN 1539 as with morphine. The withdrawal symptoms observed with WIN 1539 and morphine were similar.

The daily administration of WIN 1539 to dogs for seven weeks produced tolerance to the analgesic, sedative and hyperglycemic actions of the drug. No tolerance developed to the bradycardia or hypothermia caused by the drug. Recovery from the tolerance

<sup>\*</sup> Microfilm copy of complete manuscript of 80 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-5.

occurred in 1-2 weeks following withdrawal. Tolerance did not develop as rapidly to WIN 1539 as to morphine in contrast to results obtained in rats. Anorexia and loss of weight was not as marked in the animals receiving WIN 1539 as in those receiving morphine. A slight increase in heart rate, slight hyperglycermia, excitability and restlessness were the only symptoms noted following withdrawal of the drugs.

The pharmacological actions of WIN 1539 are very similar to those of morphine.

# PHYSICAL PERFORMANCE OF HIGH SCHOOL BOYS AND COLLEGE MEN CLASSIFIED BY THE WETZEL "GRID FOR EVALUATING PHYSICAL FITNESS"

(Publication No. 1189)\*

Robert McKinley Grueninger, Ph.D. University of Michigan, 1949

It has been inituitively obvious, since the time of the Ancient Greeks, that motor performance is closely related to the physical characteristics of the performer. While this fundamental problem of physical education has been attacked, in modern times, by many observers, and from many different points of view, the need for more definite standards of appraisal has long been felt.

The present thesis approaches the problem of performance with the help of a newer technique of classifying human subjects, namely, by the Wetzel "Grid for Evaluating Physical Fitness" which takes direct account, among other things, of body size as well as of body shape or physique. Although the Wetzel Grid had been designed as a "Control Chart on Child Growth" for the purpose of measuring and appraising the physical development of children, its basic principles and operation furnish a simple, objective means for re-investigating the question of physical performance and body structure among persons of all sizes and physiques.

A brief description of the Grid Technique is illustrated by case records and photographs, the latter, in particular, being employed to demonstrate how Grid classification by channel and level provides individual ratings for body shape and size, respectively. Exponent and Index methods are compared with corresponding Grid ratings, and it is shown that, in random samples, subjects of a single exponent or index class may actually differ greatly in size and physique. The hazards of attempting to evaluate performance in such quite heterogeneous groups is discussed.

The main results of the thesis are described in three parts:
(1) Trends of absolute and relative performance with respect to body build and body size in each of the following twelve well-known physical fitness tests,

<sup>\*</sup> Microfilm copy of complete manuscript of 359 pages, \$4.49. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A.48-398.

Burpee 10 Sec. Test Hand Grip Sargent Jump
Burpee 60 Sec. Test Parallel Bar Dips Sit-ups
Dodging Run Pull-ups Squat Jumps
440 Yard Run Push-ups Standing Broad Jump

for which 36,409 observations were made on 5,860 high school boys and college men; (2) Comparative size and physique influence in tests of strength, power, endurance, and agility; and, (3) as a supplement to such experimentally controllable observations, a survey of body size and physique as represented by Grid ratings of 5,759 athletes in eleven different sports and games.

level this consisted of (a) an increase in performance as body size increased to level 170; (b) a definite maximum in this level neighborhood, and (c) thereafter, a drop in performance in spite of continued level increase. As for physique, the pattern showed maximum performance for the stocky subjects in channels A<sub>2</sub> and A<sub>1</sub> but also a persistent decline in performance for all others. Generally, tests more responsive to level were also more affected by differences in physique. The order of effects ranged from least in the agility events to greatest in the strength tests. Physique is shown to have a greater comparative influence than level in all tests.

The present results thus emphasize the interplay of both body build and body size in determining motor achievement, and they suggest that separate allowance for these effects be made in test construction and evaluation.

Team participation as well as individual sport performance are strongly associated with body build and body size. A Chi-Square analysis of 2,198 football players proved (1) that these players as a group are different in size and physique from the general population and (2) that players of different team positions have significantly different channel and level ratings. Many athletes in other sports possess similarly distinctive body characteristics.

Grid classifications of performers are readily determined, and even more importantly, physique and body size are accurately distinguished. Such gains in accuracy of pupil classification should benefit both student and teacher by indicating a sounder basis for the prescription of exercise, by aiding in the development of performance standards, and by providing individual guidance in physical education.

#### A CRITIQUE OF TESTS AND MEASUREMENTS IN PHYSICAL EDUCATION

(Publication No. 1205)\*

Kenneth Dayton Miller, Ph.D. University of Michigan, 1949

Although the importance of a program of measurement has been recognized as a basic requirement for scientific development since the earliest period of testing in American physical education, today, after almost ninety years, an accepted program is still lacking. Chiefly responsible for this condition has been a lack of leadership in directing the growth of the field.

A problem of fundamental importance is posed by this situation. Despite a prolific accretion of tests and test materials — especially during recent years — reasonable progress has not been demonstrated. Many physical educators feel that this area has shown too much growth and too little maturation.

The purpose of this study is to indicate the need for guidance, in the hope that such will provide the base from which to initiate a movement toward the establishment of a sound and universally accepted testing program. Since the essential first step in a project of this nature is an understanding of the current condition of the field and of the developmental pattern followed in attaining that status, the offering of such a conception is the primary concern of this dissertation.

The study emphasizes the following points:

- 1. In testing there has been much duplication of effort.
- 2. This situation has resulted in refinements of existing techniques more often than it has produced a deeper understanding of the nature of the matter being tested.
- 3. There is an unwarranted variety of scoring devices applied to data of similar nature.
- 4. Despite wide useage, as far as general physical performance is concerned, it appears that height and weight are unsatisfactory elements upon which to base a classification of college men.
- 5. There is no satisfactory method of isolating neuro-muscular skills from organic fitness.

<sup>\*</sup> Microfilm copy of complete manuscript of 213 pages, \$2.67. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-6.

- 6. The Wetzel Grid, being basically a height-weight classifier, provides no significant improvement over other similar techniques in performance grouping.
- 7. There is no uniformity of opinion on what is good posture, on whether posture can be improved through exercise, or on whether posture has any influence on the normal physiological functioning of the organism.
- 8. There is too often a sacrifice of validity and reliability in the interests of test economy.
- 9. There is no field-wide agreement on basic terminology.

There is little reason for confidence in the present testing program. It is confusing beyond interest to the typical non-expert, and the concern of the student of the field is largely of an academic nature.

Conceivably a new approach to measurement is indicated by the present hodgepodge. The utilization of some of the concepts developed in studies of the organism as a whole might readily offer a new program more in accord with the biological facts of human variability and organization.

An urgent and long overdue need, at any rate, is a general clearing-house followed by continuous, positive leadership. Only through sound guidance and direction in the testing program can the goal of true professionalization be realized by physical education.

## AN INVESTIGATION OF THE ANGULAR DISTRIBUTION OF NEUTRONS FROM THE PHOTO-DISINTEGRATION OF THE DEUTERON

(Publication No. 1213)\*

Frank Genevese, Ph.D. University of Michigan, 1949

The manner in which the deuteron is photo-dissociated upon interaction with gamma radiation provides valuable information from which certain properties of two-nucleon systems may be inferred. Based upon fundamental assumptions regarding the character of the specific forces acting between nucleons and upon the nature of their interaction with the photon, current theory reveals that a complex pattern may be expected for the angular distribution of the photo-ejected nucleons. Specifically, the electric field of the gamma radiation gives rise to an electric dipole transition in which the neutrons (or protons) are ejected in an anistropic pattern conforming to a sin² law; however, a spherically symmetrical distribution is predicted for those nucleons produced by a magnetic dipole transition.

It is possible to test the validity of the theory, and consequently the assumptions upon which it is founded, by experimental measurements designed to distinguish between the contributions arising from the photomagnetic and the photoelectric effects. In the present investigation, this has been accomplished by measurement of the difference in the dependence of the differential cross section of the two effects upon the angle of ejection of the neutrons with respect to the direction of the incident photons.

In several important respects, the experimental methods employed represent improvements over former techniques. A geometrical configuration for the components of the apparatus has been selected which enhances the recorded neutron intensity while simultaneously reducing the angular opening allowed the primary gamma rays and photo-neutron beam. The recorded intensity has also been improved by the use of relatively strong gamma ray sources and by the use of BF3 neutron counter enriched in B<sup>10</sup>. The experimental corrections for neutron scattering by the heavy water and by the walls of the room have been essentially eliminated by

<sup>\*</sup> Microfilm copy of complete manuscript of 145 pages, \$1.82. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-14.

the choice of geometry and by the suspension of the apparatus outdoors at least 90 feet away from all objects.

Assuming a distribution of the form  $a \neq b \sin^2 x$ , where x is the ejection angle with respect to the incident gamma rays, a value for a/b of  $0.196 \neq 0.024$  is obtained for 2.76 Mev gamma rays. The ratio of the photomagnetic to the photoelectric cross section is found to be  $0.295 \neq 0.036$ , while the ratio of the photomagnetic to the total photo cross section becomes  $0.228 \neq 0.028$ .

The prediction, on theoretical grounds, that the total angular distribution may be resolved into an isotropic component arising from magnetic interaction and an anisotropic component arising from electric interaction is consistent with the results of this investigation. The relative magnitude of these two components conforms in general to the theoretical value predicted by theory. In contrast with early photo-disintegration experiments, the existence of a magnetic component is verified beyond doubt; it constitutes approximately 23% of the total cross section.

The weak effects predicted by non-central force theory lie well beyond present experimental capabilities. It is highly improbable that a more sensitive technique, following the present experimental scheme, can be devised to resolve these lower intensity components.

## THE USE OF THE SHOCK TUBE IN THE PRODUCTION OF UNIFORM FIELDS OF TRANSONIC AND SUPERSONIC FLOW

(Publication No. 1252)\*

Charles William Mautz, Ph.D. University of Michigan, 1949

Stationary flow-patterns in the vicinity of models placed in uniform fields of compressible fluid flow represent solutions, with known boundary conditions, of the non-linear partial differential equations which govern the motion of compressible fluids. A convenient means by which such flow-patterns may be studied is the shock tube, a tube of uniform cross-section which is divided into two chambers by a diaphragm which is caused to rupture. When the pressures on either side of the diaphragm are different, a shock wave will proceed into the chamber in which the pressure was lower.

<sup>\*</sup> Microfilm copy of complete manuscript of 131 pages, \$1.64. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-52.

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If the diaphragm is assumed to rupture instantaneously, analysis of the process following the rupture shows that the flow in the shock wave may be supersonic, depending on the shock strength, and that the period of time during which the flow is uniform at some fixed point along the tube (the test section) depends on the shock strength and on the length of the tube. In particular, the arrival of three disturbances will affect the uniformity of the flow in the test section: 1. The contact surface, an interface between the gases which were originally on either side of the diaphragm.

2. The rarefaction which proceeds into the high-pressure chamber (compression chamber) is reflected at the end, and returns.

3. The shock front which is reflected from the end of the low-pressure chamber (expansion chamber).

Of these disturbances, the one which is first to arrive will spoil the uniformity of the flow. The arrival of the contact surface may be delayed by increasing the distance from the diaphragm to the test section; the arrival of the reflected rarefaction may be delayed by increasing the length of the compression chamber; and that of the reflected shock front by increasing the distance from the test section to the end of the expansion chamber. The analysis yields curves giving the time of arrival of the various disturbances as a function of the shock strength.

Two experimental investigations were carried out using a 12 1/2-foot shock tube with a 2 x 7-inch cross-section. The diaphragm material was cellophane, which supported a difference of pressure of about one atmosphere. The speed of the shock front was measured by a technique similar to that used by Smith<sup>1</sup>, in which the passage of the shock front past two fixed stations along the tube caused optical disturbances which were converted to electrical pulses, the time-interval between which was recorded electronically. The flow-data were taken from spark-shadowgrams which were exposed at pre-determined intervals of time after the shock front had passed one of these stations upstream from the test section. The duration of the exposures was approximately 0.2 microsecond.

In the first of the two investigations, the uniformity of the Mach number in the flow was determined by measuring the shock angle of the attached bow-waves on a 5-degree wedge at eight values of the Mach number. The Mach number was found to be uniform (in time) within ranges which vary from  $\pm 0.03$  at Mach number 1.15 to  $\pm 0.007$  at Mach number 1.50.

of plane shocks in air. NDRC Report No. A-350 (OSRD Report No. 6271), November, 1945.

In the second investigation, the flow-patterns formed by models of three thicknesses and two wedge-angles were photographed. The flow-patterns were characterized by detached bow-waves, and the motions of these waves as they approached equilibrium positions upstream from the models were determined throughout the time during which the flow in the tube was uniform. These periods of uniform flow varied in length from approximately 170 microseconds at Mach number 1.5 to approximately 500 microseconds at Mach number 1.1. While the assumption that the diaphragm is instantly removed leads to prediction of durations of uniform flow in excess of those observed, there were, nonetheless, combinations of Mach number, wedge-angle, and wedge thickness which resulted in the establishment of stationary flow patterns.

### THE PUBLIC CAREER OF JOSEPH WINGATE FOLK

(Publication No. 1277)\*

Louis George Geiger, Ph.D. University of Missouri, 1948

Joseph Wingate Folk, governor of Missouri, 1905-1909, was born in Brownsville, Tennessee, October 28, 1869, the seventh in a family of ten children. He attended the local schools, read law in the office of a cousin, and graduated from the law school at Vanderbilt University in 1890. He practiced in Brownsville until 1893 when he moved to St. Louis, where he specialized in business law. He early identified himself with the younger element in city Democratic circles but held no public office until 1900, when, with the approval of Edward Butler, Democratic boss of St. Louis, he was nominated and elected circuit attorney of the city.

He became nationally famous almost overnight in 1902 by exposing a corrupt combination of franchise-grabbing corporations, dishonest city officials, and Butler. The next year his example and assistance led to the uncovering of similar conditions in the state legislature. Although he had alienated many Democratic leaders because theirs was the party in power which had to bear the blame for what Folk had exposed in Jefferson City, the general public approved his course, and practically by public acclamation he became the Democratic nominee for governor in 1904. He was the only member of his state ticket to be elected; the Republicans, assisted by the Missouri Democrats' discomfiture, the popularity of Theodore Roosevelt and the weakness of the Democratic national ticket, elected all the other state officers and a large enough majority in the lower house of the state legislature to elect a successor to the Veteran Democratic United States Senator, Francis M. Cockrell.

Although Folk had confined himself largely to an anticorruption platform when campaigning for governor, he was quick to see the inadequacy of his program, and during his administration he took his place as one of the nation's foremost advocates of progressive reform. Under his urging the Forty-Third and Forty-Fourth General Assemblies wrote an impressive body of reform legislature which established Missouri firmly in the ranks of the states which had accepted progressive doctrine. As an administrator,

<sup>\*</sup> Microfilm copy of complete manuscript of 380 pages, \$4.75. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-77.

too, Folk fully reflected the new spirit, with law enforcement as the central theme of his policy. Folk worked hard, and despite some failures which attracted hostile comment, to good purpose. His administration was highly commended at its close, except by those he had offended or by his political enemies.

Throughout his life Folk never ceased to espouse the cause of the public interest in terms of the progressive ideas of his time. Between 1908 and 1912, as a chautauqua lecturer and a candidate for the Presidency he preached his doctrine of "Equal rights to all; special privileges to none" all over the country. He was a consistent defender of the policies of the Wilson administration, which he entered as Solicitor General of the State Department in 1913. The next year he became chief counsel of the Interstate Commerce Commission, where his most publicized performance was his conduct of the New Haven investigations. During the World War and the controversy which followed over the League of Nations, Folk spoke often to advocate an international agency to keep the peace.

In 1918 Folk left federal service and returned to Missouri, where he made his second unsuccessful race for the Senate. He returned to Washington in 1919 and began the practice of international law; among his clients were the Wafd, the nationalist independence party of Egypt, and the government of Peru.

He died in New York on May 23, 1923.

## FRENCH CONSTITUTIONALISM AND THE SOCIAL QUESTION

(Publication No. 1279)\*

Robert Frederick Karsch, Ph.D. University of Missouri, 1948

The social and economic complexities of modern times present to the respective democratic governments of the world a fundamental challenge in the form of the following demands: (1) that the economy of the country be directed so as to serve primarily the interests of society as a whole rather than the interests of individuals or select groups; (2) that better working conditions and

<sup>\*</sup> Microfilm copy of complete manuscript of 221 pages, \$2.77. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-79.

a higher standard of living be provided for the laboring man; (3) that all classes of unfortunates be given the assistance necessary for normal and decent living; (4) that education be generally extended and intensified as the essential foundation for permanent progress; and (5) that national problems be fitted into their proper world context in the interests of an integral and sure solution.

The French Constitution of 1946, taken as a whole, appears to provide the constitutional basis and machinery needed for a satisfactory meeting of this challenge in France at the present time. Without discounting the extensive influence exerted by domestic political uncertainties and the imponderables of international power politics, it nevertheless may be noted (1) that the new Constitution contains a declaration of rights quite complete in its envisagement of the proper directions of needed social reform, (2) that the instrument provides an adequate basis for the assurance of popular sovereignty, without which the maximum expectation warrantable would be benevolent despotism, (3) that it outlines a procedure for ministerial leadership and responsibility which should result in greater legislative effectiveness than in the past, (4) that it sets forth an enlightened policy and improved machinery for colonial regeneration, and (5) that it offers to accept an impairment of French sovereignty, on the condition of reciprocity by other nations, in the interests of the prosperity and peace of the world.

Each of these evidences of constitutional social awareness has behind it a considerable historical background and also a basis in current French life. Hence the Constitution, far from being an idealistic creation comparable to, say, the document of 1799, appears as quite a pragmatic step in French constitutional development. Through considerable travail the people of France have laid out a legal substratum calculated to facilitate a happy response to the economic and social realities of the times.

The success of the instrument will of course hang largely on the French people themselves, on the wisdom and vigor of their leaders, and on the solution of the profound riddle of international security. Nevertheless, as de Gaulle has declared, the constitutional framework will aid or impede the task of the workers as they enter the Fourth Republic.

# STATUTORY REGULATION OF LOBBYING IN THE UNITED STATES, WITH SPECIAL REFERENCE THE FEDERAL REGULATION OF LOBBYING ACT OF 1946

(Publication No. 1250)\*

Edgar Lane, Ph. D. University of Michigan, 1949

This dissertation deals with the statutes by which American legislatures have sought to regulate lobbying. This study is not an all-inclusive analysis of lobbying; it is a study of the content and utility of the legal mechanisms by which the legislatures have attempted to control lobbying. For the purposes of this study, the term "lobbying" is assigned the general meaning of outside attempts to secure or prevent legislative action.

The Federal Regulation of Lobbying Act of 1946 draws considerably from the earlier state regulatory experience. Therefore, Chapter One describes the development of statutory regulation of lobbying in the states and sketches briefly the factors which conditioned the states' entrance into this field of regulation. Prior to 1890 state lobbying laws were confined to the prohibition of corrupt lobbying practices. From 1890 onward, however, the main purpose of state lobbying laws has been to inform the legislatures of the identity, resources, and activities of lobbyists. These laws presume that this information will enable the legislatures to strike a better balance between the claims of the many individuals and groups which today seek to influence legislative action.

In Chapter Two, the textual content and operating effectiveness of these state laws are examined. In this examination, both secondary sources and correspondence with state officials are utilized.

Chapter Three deals with the historical development of lobbying before Congress and with Congressional proposals for its regulation prior to 1946.

The background, legislative history, textual content, and operating effectiveness of the Federal Regulation of Lobbying Act of 1946 are discussed in Chapter Four. Secondary sources and field research by the writer are utilized in this chapter.

<sup>\*</sup> Microfilm copy of complete manuscript of 355 pages, \$4.44. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-50.

On the basis of the foregoing analysis, the following major conclusions are drawn in Chapter Five:

- (1) State lobbying laws have not adequately fulfilled their informational purpose. In requiring registration and the submission of financial reports by individual lobbyists, these laws neglect the fact that modern lobbying is primarily a group activity.
- (2) These laws have not been thoroughly enforced.
- (3) These laws provide no means by which their aim of publicity can be systematically achieved.
- (4) On the national level, the Federal Regulation of Lobbying Act places greater emphasis on the group basis of modern lobbying by requiring quarterly reports by groups engaged in lobbying. Registration and reporting by individual lobbyists are also required.
- (5) The federal act has serious internal inconsistencies which have complicated the enforcement of the act.
- (6) The federal act suffers from the same weakness which afflicts state lobbying laws. These laws can inform legislators about group pressures, but they cannot immunize them from these pressures.
- (7) Other approaches to the problem of lobbying, such as strengthening legislative reference facilities and reestablishing party discipline, are perhaps necessary. Present regulation of lobbying laws illuminate the problem of lobbying without solving it.

#### INDIVIDUALIST ANARCHISM IN THE UNITED STATES; A SURVEY OF NATIVE ANTI-STATIST THOUGHT AND ACTION, 1827 - 1908

(Publication No. 1251)\*

James Joseph Martin, Ph.D. University of Michigan, 1949

History records an endless conflict between social interests and individual rights. Society, organized as the state, has become progressively stronger since the Industrial Revolution. The machine age produced vast inequalities of wealth. Machines and wealth gave to those who controlled them tremendous powers over the social and economic lives of the people. The struggle for control of government policies by wealth, and by the masses for the control of wealth, greatly enhanced the social interest at the expense of individual freedom. Strong individualists fought against the trend, and those who went so far as to advocate a stateless society are known as anarchists, their philosophy as anarchism.

Although the better known anarchists have been Europeans, Americans have made rich contributions to anarchistic literature, as well as virtually the only practical attempts at putting their theories into operation. The native American anti-statists have received the designation of "individualists" in order to distinguish them from the "communist" anarchists of Europe, adherents to the goal of collectivism in a system of decentralized autonomous communes.

American anarchist sociology revolved around Josiah Warren's principles, "sovereignty of the individual" and "cost the limit of price." The individual was considered the only entity, society being merely a combination of individuals. Solution to human problems was considered possible only through first bringing economic relations into harmony. This depended upon complete freedom of opportunity, which was claimed impossible when preceded by the organization of government in the sense of the state, conceived solely in terms of an engine of oppression and exploitation. Equal access to land, raw materials, credit, and markets, accompanied by unimpeded competition and governed by a system of exchange geared strictly to cost of production, were the economic conditions to an

<sup>\*</sup> Microfilm copy of complete manuscript of 566 pages, \$7.08. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-51.

equitable society. Despite differences in material status resulting from inequalities of skill, intelligence, and utilization of energy, the anarchists felt that stability would be logically achieved thereafter through community life founded on voluntary association and cooperation, rendering the coercive functions of the state unnecessary.

In the United States, there is a distinct cleavage between intellectual opposition to authority and the scientific program of the individualist anarchists. The principal proponents of this philosophy were almost all New Englanders with colonial antecedents. Warren was the first of these, his ideas and practical demonstrations being the basis upon which the greater part of the movement rested. His early "time stores" and the communities inspired by him were socio-economic experiments of considerable originality. The center of this experimentation was the Mid-west, moving to the East around 1850.

Later in the century the movement became purely propagandistic, with the stress being placed on a fight against the "four monopolies" of land, money, tariffs, and patents and copyrights. Participation in the campaign of agitation became nation-wide, resulting in the production of a vast amount of printed materials. Warren's program of mostly self-sufficient communities functioning under a cost exchange economy and without officialdom was abandoned, in the hope of realizing this far wider objective. Prominent among the participants were Warren's associates; Stephen Pearl Andrews, William B. Greene, Lysander Spooner, J. K. Ingalls, and Warren's intellectual heirs; Ezra Heywood and Benjamin R. Tucker. The destruction of their publication center by fire in 1908 fragmented an already declining movement. Communist anarchism and syndicalism have been the most widespread antistatist philosophies since that time.

#### THE POLITICAL PHILOSOPHY OF BENJAMIN FRANKLIN: THE BEGINNING OF THE PRAGMATIC TRADITION IN AMERICAN POLITICAL THOUGHT

(Publication No. 1206)\*

Richard Donald Miles, Ph.D. University of Michigan, 1949

Although many political theorists at the time of the American Revolution developed their ideas around the natural rights of man as a central concept, at least one important American thinker made a quite different sort of approach to the problem of human government. Benjamin Franklin developed his political ideas ad hoc, and with great concern as to their workability; yet his political philosophy as finally constructed was one of extraordinary intellectual merit, and it was the foundation for a pragmatic tradition in American political thought.

From the first, Franklin was the practical theorist, dealing with specific political problems as the occasion for expressing basic ideas. The earliest of such issues was the Pennsylvania paper currency controversy of 1729, and at that time he gave important expression to one of the enduring tenets of his political thinking, the primacy of the general good as a guide to political action. The matter of provincial defense was another early issue which elicited further statement of this tenet.

The Albany Plan of 1754 marks the beginning of the imperial interpretation of general good in Franklin's thought; there and in his three letters to Governor Shirley of December, 1754, he gave vigorous emphasis to the importance of the workability of government, as well. This was his main theme in his campaign to substitute royal government for proprietary rule in Pennsylvania and Maryland during his first agency in England in the years 1757-1762.

When the "New Policy" was attempted by British statesmen after 1763, Franklin relied on their enlightened self-interest to avoid extreme oppression of the American colonies. The Stamp Act controversy, however, led him to emphasize the extension of the British constitution overseas as a further assurance of the welfare of the entire empire. Based on statements in his letters to Governor Shirley in 1754, Franklin's constitutionalism as another

<sup>\*</sup> Microfilm copy of complete manuscript of 303 pages, \$3.79. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-7.

tenet of his political thinking demonstrated his belief in the rights, not of humans derived from nature, but of Englishmen guaranteed by documents.

Franklin's continual search for a formula of empire gradually gave way to his concern for the rights of Englishmen in America, as the two projects became increasingly incompatible. This trend was expressed cautiously and privately at first, in marginalia and in anonymous newspaper writings; but after his appointment as Massachusetts agent late in 1770, he communicated his advanced ideas to leaders in that colony, and may have had much influence there until the humiliation of the Hutchinson letters affair stayed his pen early in 1774.

By the following year the breach seemed certain to Franklin, yet he continued attempts to effect an empire which would not injure American rights. The final choice of the latter as the more important goal was made with relatively little hesitation, and once it was made, Franklin worked with surprising energy to achieve the supreme vindication of his political thought, the practical workability of a new government.

There is little mention of the notion of natural rights in Frank-lin's writings, and none which affects his political thought importantly. To the last, Franklin developed his ideas with reference to specific problems, and in the course of this he relied increasingly on humanitarianism and on democracy as approaches to the formulation of a political philosophy essentially pragmatic in character—one which held the efficacy of government in creating the greatest general good as the highest political achievement.

## THE ORGANIZATION OF A MUNICIPAL CORPORATION IN OHIO

(Publication No. 1263)\*

Harold Theodore Towe, Ph.D. University of Michigan, 1949

This is a study in Public Law — American municipal law, to be precise. It deals with an average unincorporated community in Ohio. The problems involve sanitation, water supply, fire and police protection, building and zoning and other services and functions needed in modern times. Residents have learned that such

<sup>\*</sup> Microfilm copy of complete manuscript of 310 pages, \$3.88. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-63.

activities cannot be obtained in their unincorporated status. Examination of the forty-four Chio incorporations since 1930 indicates that the over-all reason for incorporation was to secure the services denied them under township government. Rossford in Wood County, Ohio, was taken to serve as the model to describe the transition from an unincorporated status to a municipal corporation. Rossford exhausted all possible avenues of aid and thenturned to incorporation as its solution. Currently in Ohio there are two methods of incorporation: The first is by petition to the county commissioners upon whom the decision devolves, and the second is by petition to the township trustees upon whom rests a mandatory duty to set a date for submission of the question to the voters. Rossford chose the latter procedure. Since few people realize that a new municipality does not just happen, the author attempts to bring out that it too is born. Like individuals, it must be brought into the world and sent upon its way with the proper preparation.

Part I includes a brief historical, economic and social background to the Rossford incorporation movement; a legislative history of incorporation in Ohio; an examination of the reasons for incorporation and the causes for the dissolutions of municipal corporation in Ohio since 1930; and an enumeration of the advantages of incorporation.

Part II deals with the municipal government of Rossford, more specifically, the establishment of offices and administration for the various functions. The different chapters indicate the development of a municipal corporation as measured by the nature and origin of the activities as they have created problems.

Charts reveal the sources of municipal revenue and the percentage distribution of the various taxes over the period 1940-1948. A recent check of the forty-four incorporations shows that none of them are having financial difficulties, while study of the dissolutions discloses only one experienced financial trouble. Rossford has been fortunate to have industry including a large, successful glass plant which pays approximately 45 per cent of the village tax income.

Five chapters are devoted to intergovernmental relations which lead to the conclusion that a municipal corporation cannot be efficiently and effectively managed without the local administration maintaining such intergovernmental relations as will insure a complete harmony of local effort. There must be a vigilant endeavor to discover and promote ideas for achieving smoother coordination between local-state-federal activities within the area.

The study is based upon first hand information. The matters discussed have not been hypothetical situations, but actual problems presented for solution in the conception and infant days of a living

municipal corporation. Village records and opinions of the author as legal advisor make up the greater part of the study. It has not been the intent of the writer to give his views of what ought to be the functions and scope of the municipal government of Rossford, but rather an effort to present the real questions, problems, conflicts and their solutions that actually have arisen in the day-to-day operation of this municipality.

The author believes that too little attention has been given to the underlying causes of the constant increase in the number of political subdivisions. As long as there is no rural municipality which is capable of meeting the challenge of the rural dwellers, and as long as county home rule fails to become a reality, the necessity for incorporation will exist. This is the only practical means for furnishing necessary services. If a minimum population requirement is established as a prerequisite for incorporation, then the township government would need to be given sufficient authority to serve the unincorporated people properly and adequately. At the present time, an unincorporated community must incorporate in order to obtain home rule which enables a municipality to regulate and protect its own development; in other words, it permits the local people, with some reservations, to solve their local problems as they see fit.

### THE FACTORS OF INTEREST IN THE COUNSELING OF ADULTS

(Publication No. 1272)\*

George Charles Beamer, Ph.D. University of Missouri, 1947

Purpose

To examine critically the factor of interest in the counseling of adults who were veterans of World War II was the primary purpose of this study.

Why Needed

Students who are veterans of World War II as well as other adults who desire education, need guidance which will enable them to obtain the greatest benefit in the shortest length of time from the educational program of which they are a part.

Instruments and techniques of guidance need to be examined in relation to this unique type of student. In this study two of these instruments, the Strong Vocational Interest Blank for Men (Revised) and the Kuder Preference Record (Form BB) were examined critically as used with this group of persons chronologically older than and of experience different from that of the ordinary college student.

#### Method of Research

The interests as measured by the Strong and Kuder inventories of 296 men were studied. These men had been counseled by the University of Missouri Counseling Bureau.

One hundred ninety-two veterans (average age 23.3 years) were given the Strong inventory and 104 veterans (average age 23.4 years) were given the Kuder inventory.

The Pearson product-moment correlation and the analysis of correlation tables were the techniques used in treating the data.

#### Conclusions

1. The counselees who are veterans of World War II are older when they enter school than most of their fellow students are when they finish a four-year college course. These men have definite interests but were found to need counseling to aid them in deciding upon an adequate vocational objective. These men show no greater

<sup>\*</sup> Microfilm copy of complete manuscript of 274 pages, \$3.43. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-72.

interest maturity regardless of age and experience. The adults studied differ from the men of Strong's criterion groups in that their occupational level is lower than that of those men actually engaged in the occupation.

2. There is a definitely negative correlation between the advertising man and author-journalist interest scales of the Strong inventory and the Kuder persuasive interest scale and average grades in courses preparatory to a vocational objective. A significant correlation was found between specific occupational interest scales and specific grades. There were no significant correlations found, however, between various interest ratings and average grades in subjects preparatory to a vocational objective.

3. Primary interests have an effect on achievement in courses preparatory to a vocational objective since there were recurring trends of students doing better work and staying with their chosen objective more persistently when their vocational interests as measured were high.

4. The Strong and Kuder inventories select men of homogeneity of vocational interests, not only of homogeneith among themselves, but also with men actually engaged in certain occupations.

5. The Strong and Kuder inventories were found to be useful in discovering general areas of interest of adults; the Strong test is useful in discovering interests in specific occupations as well.

6. Proper use of the tests was found to be the most effective improvement in the use of the tests. Full preliminary scoring and interpretation of both tests was found necessary. Interest profiles were discovered and constructed for the men of each vocational objective studied. These profiles may be used as "direction finders" in interpreting the tests. Composite scores give a more accurate appraisal of the counselee's interests than single scores.

The use of the non-occupational scales on the Strong inventory in interpreting a particular counselee's score should be extended. Particular emphasis on the occupational level scale should be made with groups of adults.

#### Recommendations

1. Similar studies should be made of the Strong and Kuder interest inventories as used with groups of adults of vocational objectives other than those objectives included in this study.

2. Other occupational groups should be added to the group scales of the Strong test and the individual occupational scales of this test should be extended and further refined to a degree that just as the present form predicts achievement in subjects which contribute directly to adjustment and satisfaction in the attainment of a vocational objective so can achievement be predicted for large numbers of other courses.

3. A study should be made of the specific courses between which and interest ratings there is a significant correlation, to determine the factors which make this relationship significant so that the same factors can be made to operate in other courses.

## LEADERS AND THEIR ABILITY TO EVALUATE GROUP OPINION

(Publication No. 1168)\*

Kamla Chowdhry, Ph. D. University of Michigan, 1949

This experiment was concerned with testing the hypothesis that (a) chosen leaders of a group are superior to non-leaders and isolates in estimating group opinion; (b) there is a difference in the estimation of familiar and unfamiliar issues; (c) leaders have a higher degree of identification with the group on the familiar issues.

#### Procedure

Four groups were selected and designated as, the Religious, Political, Professional Fraternity, and Professional Sorority groups. All of these organized around a definite pattern of interest, allowed sufficient interaction for the emergence of leadership, and represented a variety of common group organization.

The questionnaire used in each group was subdivided in three parts with an attempt to get at three levels of familiarity with, and relevance to the groups' interests. Issues in part A were designed to be the most familiar and relevant, in part C the least, and the issues in part B intermediary. Each individual responded to each item in two ways: First, by giving his own agreement or disagreement with the item, and secondly, by estimating the percentage of the group that would agree with the item. Sociometric data allowing three choices on each of the four criteria of leadership were also collected. The total choices received were used to differentiate leaders from non-leaders, the latter including those who did not receive a single vote and who were termed isolates.

Sensitivity to group opinion and the degree of identification with the group were then measured. By sensitivity was meant the

<sup>\*</sup> Microfilm copy of 'complete manuscript of 154 pages, \$1.93. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number A 48-377.

individual's ability to estimate accurately the responses which the group gives to items in a questionnaire. By degree of identification with the group was meant the relation of commonality between the individual's own opinions and the opinions of the group as he perceived them.

#### Results

Results in sensitivity show that in part A, the leaders estimate group opinion with significantly superior accuracy than do non-leaders and isolates, the difference between leaders and isolates usually being greater than between leaders and non-leaders. In part C there is no significant difference.

Results in identification in part A show that leaders always have a higher degree of identification than non-leaders and isolates, but this difference is not seen in part C.

On part B, there were no consistent results.

#### Conclusions

Results indicate that sensitivity to, and identification with, the group are traits common to chosen leaders in different kinds of situations; and that to the extent these traits cannot be transferred from one situation to another, to that extent leadership is limited to the specific situation.

The status that an individual acquires in a group also seems to be related to his sensitivity and his degree of identification with the group. These traits in turn seem to be functions of the channels of communication in the group, and the understanding of goals that may result for the individual.

## EFFECTS OF VARIATION IN LEADERSHIP ON PARTICIPANT BEHAVIOR IN DISCUSSION GROUPS

(Publication No. 1172)\*

Roger William Heyns, Ph.D. University of Michigan, 1949

#### Problem

This experiment was designed to determine the effect of variation in leadership on problem-solving, interpersonal and communication variables in conferences, and the relationship of these

<sup>\*</sup> Microfilm copy of complete manuscript of 249 pages, \$3.12 Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number A 48-381.

process variables to decision quality and participant satisfaction with decision, group procedure and leader performance.

#### Procedure

Four groups of undergraduate students discussed a personnel-relations problem for an hour. In two groups, the leader attempted to increase understanding, create an impression of group unity, increase members' feeling of being accepted, promote favorable attitudes among members toward each other and aid the problem-solving process. In the remaining groups, the leader's behavior was calculated to have negative effects on these variables. Data were gathered by direct observations, wire recordings and questionnaires. The contributions of each participant were classified on the basis of the problem-solving function performed. The functional categories permitted reliable, quantitative description of problem-solving behavior.

#### Results

Leadership effects on process variables

Leadership style variation produced significant problemsolving behavior differences between sets of groups, notably relatively more supporting and fewer opposing contributions in the positive-style groups. There were no differences in the amount of understanding among participants, their perception of group unity, their feeling of being accepted, their acceptability to their colleagues as participants and persons.

There were, however, marked effects of leader variation on the relationships among the problem-solving and interpersonal variables in the two sets of groups. Members performing leadership functions neglected by the leader were well accepted, whereas members performing these functions when the leader performed them satisfactorily were less well regarded by colleagues. High participators were well accepted as participants when they performed functions neglected by the leader; when the leader performed them, they were no more acceptable than their less active colleagues. Opposing behavior was perceived as rejecting, in an atmosphere of supporting and the opposer was less acceptable to his fellows while, in an atmosphere of opposing, this behavior was not interpreted as rejecting and the opposer was not disliked.

Leadership effects on outcomes.

The only outcome related to leadership-style variation was satisfaction with the leader's performance; the positive-style groups were most satisfied with the leader. There were no differences between sets in quality of solutions. These findings indicate

that a considerable range of leader behavior on interpersonal, problem-solving and communication variables is necessary before effects on conference outcomes become evident.

Relationship of process variables to outcomes.

The individuals who perceived their groups as unified, who felt accepted as members and those who were most accepted by colleagues as participants and as persons were more satisfied with the group decision than were their fellow participants. The problem solving functions performed by the individual were, by and large, unrelated to his satisfactions; however, the amount of supporting and summarizing done by the participant was positively related to his decision satisfaction. In the positive-style groups, personal liking for the leader was positively related to decision satisfaction; in the negative-style groups, the relationship was negative.

## INDIVIDUAL CONFORMITY TO ATTITUDES OF FACE-TO-FACE GROUPS

(Publication No. 1253)\*

Wilbert J. McKeachie, Ph. D. University of Michigan, 1949

#### 1. Problem

To study the problem of the relationship of the individual's attitudes to group norms, the following hypotheses were tested:

1. Attitude changes of group members are positively correlated with changes in their perceptions of the group norm.

2. There will be a higher positive correlation between attitudes of group members and their perceptions of the group norms in groups in which there is a greater feeling of membership and liking for the group than in groups in which there is less feeling of membership and liking for the group.

#### Corollaries:

The correlation between attitude and perceived group norm will be higher for members with greater

- a. liking for the group.
- b. feeling of membership in the group.
- c. feeling of being liked by the group.

<sup>\*</sup> Microfilm copy of complete manuscript of 68 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number A 49-53...

3. The correlation between attitude and perceived group norm will be lower on attitude tests taken after taking part in a group decision preceded by a group discussion about the problem than on tests taken after listening to a lecture and writing an essay about the best solution to the problem.

#### 2. Procedures

To test these hypotheses three instructors in the elementary psychology course taught each of their two sections in different ways. In one section the instructor encouraged interaction between class members and permitted them to decide about many of the aspects of class routine. In the other section, he asked and answered questions and announced matters of class routine.

Within each of these sections three different procedures dealing with specific attitudes were used for one day each. These methods were (1) lecture and secret vote, (2) lecture, secret vote, and results of vote announced, and (3) group discussion and decision.

These methods were used with three attitudes tested at the beginning and end of the semester by standard attitude scales.

#### 3. Results

Attitude change was significantly positively correlated with change in perceived group norm. However, there was a lower correlation between attitude and perceived group norm in group-centered classes than in leader-centered classes, in which there was less liking for the group. Students with much liking for the group did not conform to perceived group norms more than those with less liking, but students with a high feeling of membership in the group conformed more than those with less feeling of membership. Feeling of being liked by other members of the group was not related to conformity except that ten individuals who were not liked by the group as much as they thought did not conform as much as other group members.

The correlation between attitude and perceived group norm was lower for students taking part in a group decision than for those who listened to a lecture. This correlation was also lower for attitude toward the negro than for attitude toward the treatment of criminals.

#### 4. Conclusions

Individual conformity to perceived group norms is related to perception of the norm, type of group, manner in which the attitude has been treated in the group, personality of the individual, and the attitude involved.

#### A STUDY OF CERTAIN FACTORS RELATED TO QUALITY OF WORK-GROUP LEADERSHIP

(Publication No. 1254)\*

Herbert Henry Meyer, Ph.D. University of Michigan, 1949

The general purpose of this study is to identify certain measurable characteristics related to quality of work-group leadership-Quality of leadership is defined specifically as the ability to gain the cooperation and respect of the members of the group led, and, in general, the ability to handle the human relations problems that arise in a functioning work-group situation.

The study was carried out in a large utility company. Several tests were administered to, and other quantifiable data were obtained from, approximately two hundred first-line supervisors. In addition, detailed ratings were obtained from the supervisors' superiors. The ratings were obtained with a check-list type rating scale. This provided a detailed description, from which an objective score could be derived, of the way in which each supervisor handled the human relations aspect of his job. The various relationships between these measures were determined. The data were analyzed for supervisors of office workers and supervisors of manual workers considered separately, as well as for the sample as a whole.

Whereas a test to measure knowledge of leadership skill was unsuccessful, a test designed to measure one's social attitudes was found to correlate significantly with the criterion measure of leadership success. This relationship was found to be equally significant for supervisors of the two different types of work groups. The test was designed to function as a projective test. The testee was asked to predict the behavior of other persons, who were described briefly, in certain interpersonal situations. It was felt that in making this prediction the testee would reveal his true attitude toward other persons through projection. Evidence was presented to indicate that the good leader regards others as individuals with motives, feelings, and goals of their own, whereas the poor leader is more likely to perceive others in relation to his own motives or goals.

<sup>\*</sup> Microfilm copy of complete manuscript of 202 pages, \$2.53. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number A 49-54.

An inventory for obtaining information concerning one's interests and background or personal history was also administered to the supervisors. Many more differences which attained at least the 5 per cent level of significance were found between "good" and "poor" supervisors on interest items than on personal history items. For example, the good leaders had participated more in most athletic sports than had the poor, according to their reports. Some tendency was evident for more of the good leaders to prefer occupations in which it is necessary to deal with people. The parents of good supervisors were reported to have had more education and to have been happier than those of the poor supervisors. Differences were found on many other items of a similar nature.

It was concluded that, although the major contribution which the study makes is probably the usefulness of the results for predicting leadership success, the study also has important implications for training leaders. That is, since a test to measure knowledge of leadership skills was unsuccessful, while scores on a test designed to measure one's social attitudes did correlate with quality of leadership, perhaps leadership training should concentrate on changing attitudes, rather than attempting to change performance by teaching skills.

### MOTIVATIONAL EFFECTS IN THE PERCEPTION OF SOCIAL "GATEKEEPERS"

(Publication No. 1257)\*

Albert Davison Pepitone, Ph. D. University of Michigan, 1949

This study is concerned with the influence of motivation on the perception and evaluation of individuals who possess the exclusive responsibility for allowing or preventing goal achievement, i.e., "Gatekeepers."

The experiment involved eighty-eight high school boys differentially motivated to secure a free ticket to a University Conference basketball game. A High or Low level of motivation was induced by systematically enhancing or depreciating the value of the "ticket incentive" in a talk given to each subject.

<sup>\*</sup> Microfilm copy of complete manuscript of 142 pages, \$1.78. Enlargements 6" 8", 10¢ per page. Library of Congress Card Number Mic A 49-57.

Each subject was required to face a three man "board" whose function was to ask the subject's opinions in sports and to decide collectively whether or not to award him a ticket. The total behavior of the boardmembers toward each other and the subject was prescribed by a script containing specific dialogue designed to express different intensities of approval and authority. After each of the differentially motivated subjects experienced one of three such scripts he was interviewed as to his perceptions and evaluations of the boardmembers. The three scripts or stimulus conditions can be described as follows:

- A. Friendly-Hostile: Included a very approving, a non-evaluative, and a negative boardmember. Authority was equated for the three boardmembers at a medium level.
- B. Friendly-Neutral: Included a very approving, a moderately approving, and a non-evaluative boardmember. Authority was equated for the three boardmembers at a medium level.
- C. Friendly-Authority: Included boardmembers with High, Medium and Low authority. Approval was equated for the three boardmembers at a moderate level.

The following results are statistically significant unless otherwise noted:

- 1. In conditions A and B, the most approving boardmember is perceived as most authoritative and the least approving as weakest in authority.
- 2. In condition C, the most authoritative boardmember is perceived as the most approving and the least authoritative as least approving.
- 3. In conditions A and B, the most approving boardmember is most highly evaluated and the least approving is evaluated lowest.
- 4. In condition C, the most authoritative boardmember is evaluated highest and the least authoritative is evaluated lowest.
- 5. In condition A, High Motivation (compared with Low) makes for the perception of greater authority and greater approval in the most approving boardmember.

- 6. In condition A, the most approving boardmember is evaluated higher by the High Motivation Subjects (compared with Low).
- 7. In condition B, High Motivation (compared with Low) makes for the perception of less authority in the non-evaluative board-member.
- 8. In condition B, High Motivation (compared with Low) makes for increased sensitivity in the perception of approval.
- 9. In condition C, High Motivation (compared with Low) makes no difference in the magnitude of perceived approval or authority.

The general conclusion reached was that motivation functions to organize the perception of approval and authority in such a way as to minimize restraint against goal achievement. The degree of such a "facilitative organization" depends upon the severity of the restraint. Inferences were also made concerning the relationship of perceived approval and evaluation, and noted finally were various implications for future research in social perception.

#### DREAM ANALYSIS FOR THE INDICATION OF DIFFERENTIAL DIAGNOSIS

(Publication No. 1219)\*

Robert Samuel Redmount, Ph.D. New York University, 1949

The investigator devised a method of dream analysis in which manifest dream content as it was related by the dreamer, was used as a projective technique of the type devised by Rorschach.<sup>1</sup>

<sup>\*</sup> Microfilm copy of complete manuscript of 259 pages, \$3.24. Enlargements 6" x 8", 10¢ per page, Library of Congress Card Number A 49-20.

<sup>1.</sup> H. Rorschach, <u>Psychodiagnostics</u>. New York: Grune and Stratton, Incorporated, 1942

The investigator wished to determine if this method of dream analysis would produce reliable and systematic differences between the dreams of a group of subjects diagnosed anxiety neurotic and the dreams of a group of subjects diagnosed "normal."

The method of dream analysis was constructed within the framework of Freud's<sup>2</sup> theoretical system of behavior. Clinical meanings for the various categories of the method of analysis were hypothesized by the investigator in keeping with Freud's basic tenets of (1) different levels of behavior, (2) symbolic operatives affecting movement and adjustment between the different levels of behavior, and (3) the operation of defense mechanism which seek to preserve the behavior integration of the individual.

Two groups of subjects were used in the study, one group consisted of ten males and six females who were recently diagnosed anxiety neurotics by psychiatric and psychological examination in public mental institutions. The other group of subjects consisted of thirteen males and twelve females who, on the basis of diagnostic psychological test results, primarily, were diagnosed "normal" by the investigator. The subjects of both groups were between twenty-one and fifty years of age. All of the subjects were without evidence of physical disability or pathological physical disturbance.

All of the subjects in the study supplied background information about their age, family composition, family solidarity, family occupations, educational training, marital status and adjustment, and personal vocations.

All of the subjects in the study were administered the Wechsler-Bellevue Intelligence Scale, the Rorschach Test and the Thematic Apperception Test in order to secure an intellectual and personality evaluation of the subjects.

All of the subjects related as many dreams as they could recall over a two-week period. Every subject related at least one dream and no more than ten dreams of any one subject were used in the study.

With respect to the background information about the subjects, statistically significant differences between the two groups were found in terms of marital status, in types of family and personal occupations and in the extent of educational training. The "normal" group reflected higher socio-economic status in the last named characteristics and were mostly unmarried.

The two groups were both of bright normal intelligence, with the normal group presenting statistically significantly greater consistency in intellectual approach and organization. The personality

<sup>2.</sup> S. Freud, The Basic Writings of Sigmund Freud. New York: Random House, Incorporated, 1938.

test scores of the anxiety neurotic group corresponded to the established anxiety neurotic test patterns. The "normal" group personality test scores corresponded to the established patterns for normal subjects.

There were no significant differences in patterns of category frequency, the basis for dream analysis, between the anxiety neurotic and normal subjects. The average number of dreams for each anxiety neurotic subject was 4.81 as compared with 3.64 for the normal subject, a statistically significant difference. There were no distinctive individual patterns of dream frequency.

The devised method of dream analysis does not distinguish between the manifest dream content of two different clinical groups. Dream analysis as a projective technique of the Rorschac type is ineffective in assisting in the differential diagnosis of normal and anxiety neurotic subjects.

A more effective method of dream analysis would appear to be that which studies the dream in relation to its possible precipitating factors, and which considers the dream as only one facet of the total area of attention. The relative effects of repression and subjects' socio-economic status on the content of a dream should be studied thoroughly.

### A STUDY OF PERSONALITY RATINGS BASED ON BRIEF OBSERVATION OF BEHAVIOR IN STANDARD SITUATIONS

(Publication No. 1208)\*

William F. Soskin, Ph.D. University of Michigan, 1949

In the course of an intensive assessment of 128 male firstyear graduate students in clinical psychology each subject participated in a series of five types of standard situations under the observation of experienced psychologists working on two types of rating teams, each of whom rated the subject on a group of thirtyone variables.

Team A first rated the subject on the basis of interviews, test scores and personal documents. Then, after observing his performance in the standard situations and studying certain other data, Team A made a set of final pooled (FinP) ratings, the criterion in

<sup>\*</sup> Microfilm copy of complete manuscript of 77 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-9.

this study. Team B, having had no previous familiarity with the subject, rated him solely on the basis of his performance in the situations (SitP ratings). A third type of rating (TI ratings) was made by persons who formed their judgments solely on the basis of "blind" analysis of objective and projective tests and personal documents.

In this study Team B ratings were compared with ratings by the other types of judges. It was found that:

- (1) The reliabilities of ratings by individuals were rather low, although the reliabilities of pooled ratings were moderately good for most variables.
- (2) For all variables the correlation between SitP ratings and FinP (criterion) ratings was significant at the one per cent level, although variables differed significantly with respect to the validity (i.e., agreement with criterion) with which they could be rated from behavior observed in situations.
- (3) For certain variables SitP ratings were found capable of accounting for a greater portion of the total variance than were either PreP or TI ratings.
- (4) Individuals differed significantly in ability to rate the thirtyone variables solely on the basis of behavior observed in the standard situations.
- (5) The distinguishing feature between "good" and "poor" raters was that the "good" raters were able to rate so-called phenotypical and genotypical variables about equally well from observations in the standard situations, whereas the "poor" judges were significantly less able to rate the genotypical variables.

### ATTITUDE DISPERSION AND ITS PERCEPTION AS RELATED TO SATISFACTION WITH A GROUP PRODUCT

(Publication No. 1259)\*

Philip Irving Sperling, Ph.D. University of Michigan, 1949

Testing the hypothesis that higher psychological outcomes would be obtained in a group which was homogeneous and/or perceiving homogeneity on an attitude, six types of groups were

<sup>\*</sup> Microfilm copy of complete manuscript of 134 pages, \$1.68. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A.49-59.

contrasted for differences in satisfaction with the group decision. These six types were: Three homogeneous groups — one unaware of its dispersion; one perceiving homogeneity; and one perceiving heterogeneity, and three heterogeneous groups — one unaware of its dispersion; one perceiving homogeneity; and one perceiving heterogeneity. Twelve groups of about 15 college students each were selected on the basis of the group dispersion (size of sigma) on the Economic Conservatism Attitude Scale. The twelve groups were combined into six groups of the requisite types.

Perception of the attitude dispersion was reliably measured by questionnaires. Each individual indicated his concept of the spread of scores in his group; the amount of agreement among group members he thought possible, and the degree of cluster or bunching of his groups' scores along the entire range of attitude scale scores. These three ways of estimating the group's attitude dispersion were combined to form the individual's Dispersion Percept score. This latter differentiated the groups into those perceiving homogeneity, those perceiving heterogeneity, and those remaining unaware.

The members of each group were required to rank the faults of the faculty in terms of "worst," "next worst," etc. After each individual had performed this task singly, the results were consolidated on a blackboard and the fault ranked worst by the group presented to the group as the group decision. No discussion was permitted. Interaction was at a minimum.

The psychological outcomes measured were the reactions of the individuals to the knowledge of the group decision within the context of the experimental group membership. They were measured by means of questionnaires in terms of the individual group member's satisfaction with the decision, his judgment of the decision quality and his willingness to assume responsibility for the group decision. These three highly interrelated outcomes were combined to form the general outcome - General Satisfaction. The member's willingness to sign a petition relevant to the group decision was used as an index of his motivation to execute the group decision. Another psychological outcome measured was the difference between an individual's willingness to make his group's views known to an appropriate authority, before and after knowledge of the group decision. This last was an index of the apparent resistance of the individual to go along with the group and was called Impedance.

No significant inter-group differences were found for these outcomes in the direction expected by the theory on which the hypothesis was based. The null hypothesis was not rejected. What differences were found were explicable in terms of:

- possible previous history of the group membership.
- the degree of propinquity of an individual's decision relative to the group decision (the losers' effect).
- an unknown factor that was most likely related to the amount of ego-involvement of the individual in the task assigned.

# THE RELATIONSHIP OF CERTAIN VARIABLES TO DISCREPANCY BETWEEN EXPRESSED AND INVENTORIED VOCATIONAL INTEREST

(Publication No. 1264)\*

Wimburn Leroy Wallace, Ph.D. University of Michigan, 1949

Both the experience of counselors and the results of several previous investigations have demonstrated the rather common incidence of discrepancy between the vocation an individual says he is most interested in or is preparing to enter (expressed or manifest vocational interest) and his inventoried vocational interest. However, investigations into the causes or correlates of this discrepancy have not hitherto been made. Four hypotheses, concerning variables which might differentiate individuals whose inventoried interest coincides with their expressed vocational interest (non-discrepants) from those whose inventoried interest does not agree with their expressed interest (discrepants), were chosen for testing. These hypotheses were that there are no significant differences between non-discrepants and discrepants with respect to (1) mean scores on the occupational scale of the Strong Vocational Interest Blank corresponding to their expressed vocational aim when they attempt to simulate the responses of typical men in that vocation on that inventory; (2) extent of opportunity to gain information about the occupation of their choice; (3) indications of selfconflict in their attitudes toward their chosen vocation; and (4) certain specific aspects of background and self-appraisal.

The subjects were 238 male undergraduates at the University of Michigan representing three areas of vocational preparation: Medicine, engineering, and public accounting. The members of these groups were given the Strong Vocational Interest Blank, a personal data questionnaire, and the Strong Vocational Interest

<sup>\*</sup> Microfilm copy of complete manuscript of 107 pages, \$1.34. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-64.

Blank with special directions to make their responses as much like those of typical men in their chosen occupation as possible. Fisher t-tests and chi square tests of independence were applied in the analysis of the data in order to discover significant differences between non-discrepants and discrepants with respect to the variables examined.

The findings in this investigation indicate that, when non-discrepants are compared with discrepants, they attain significantly higher simulation scores on appropriate scales of the Strong, have had more opportunity to gain information about the occupation of their choice, have less self-conflict about their vocational selection, and excel in the following five specific aspects of background and self-appraisal: Self-rated strength of interest in entering occupation of choice, satisfaction with present vocation aim, self-rated similarity of own interests to those of men in chosen occupation, having had vocational counseling, and in expressing fewer disadvantages of the vocation of their choice.

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# AN ATTEMPT TO DIFFERENTIATE PARANOID SCHIZOPHRENIC PATIENTS FROM BRAIN-DAMAGED PATIENTS BY USE OF PSYCHOLOGICAL TEST PROCEDURES

(Publication No. 1217)\*

Bernard Nathan Kalinkowitz, Ph.D. New York University, 1948

The Problem

The problem was to determine how effectively the Wechsler-Bellevue and Rorschach could differentially diagnose between matched groups of paranoid schizophrenic and paretic patients. Subsidiary problems were: (a) differentiation of both groups from the normal; (b) evaluation of the diagnostic aids suggested by Rapaport, Wechsler, Allen, Greenblatt, Piotrowski, Aita, Armitage, Harrower, and others; (c) isolation of behavioral criteria which might aid in determining the paranoid schizophrenic or braindamage syndrome.

#### Methods and Procedure

Thirty male paranoid schizophrenic patients were compared to thirty male paretics, all hospitalized at Northport Veterans Hospital. The mean ages of the paranoid were 54.31 years and of the paretics 54.25. The paranoids averaged 8.33 years of schooling, and the paretics 8.23 years. As measured by the Minnesota Occupational Rating Scale (1936 Revision) there was little difference between the groups in pre-psychotic occupational status. All were World War I veterans, had not received any psychological tests for a minimum period of five years preceding the present investigation, could read, speak, and write the English language, and had attended school in the United States at least through the third year. None had received active therapy for twelve months preceding the present study.

The groups were considered chronic. Each patient had been hospitalized for a minimum period of three consecutive years, and there had been no marked change in hospital status during the twenty-four month period preceding the psychological examination. All had ground privileges, were in good contact at the time of testing, and could cooperate and sustain attention necessary for the psychological examination.

<sup>\*</sup> Microfilm copy of complete manuscript of 605 pages, \$7.57. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-18.

On the Wechsler-Bellevue (Form I), and on certain items of the Rorschach, the statistical significance of mean differences was determined by use of Fisher's small sample technique. Chi-square technique was utilized to evaluate inter-group differences when use of small sample technique was contra-indicated.

#### Results

On the Wechsler, average I. Q. of paranoids was 102.6; of paretics, 90.3. As the groups were equated for pre-psychotic intelligence, results indicated that the paretics had deteriorated, whereas the paranoids had not. The paranoid schizophrenics showed little impairment on Arithmetic while the paretics demonstrated severe impairment. In contrast, the paranoid group did poorly on Picture Completion whereas the paretics did well. Block Design did not decline markedly for the paretic group which appears to contradict the reports of previous investigators.

Criteria for detecting psychosis by means of the Wechsler were established, and by use of these criteria, 72% of the patient

population could have been identified as psychotic.

On the Rorschach, the paretics rejected more cards than did the paranoids, had a lower mean response total, gave one-third the number of M responses, and gave fewer Fc responses. These differences were statistically significant. The paranoid schizophrenics produced many more M- responses, had greater dilation of the experience balance, a higher H% and (H)% total, produced a greater number of P and O responses, and could accept more readily the concepts suggested in "testing the limits." Piotrowski's signs of organicity and Bohm's signs for schizophrenia were found to be effective aids in the differential diagnosis of the two groups.

Criteria for detecting psychosis by means of the Rorschach were established, and using these criteria, 83% of the paretics and 67% of the paranoids could have been diagnosed as psychotic.

Cluster of signs were isolated for the identification of the paranoid schizophrenic and brain-damaged syndromes. Utilizing this technique 90% of the paretics were found to have brain-damage, but 27% of these appeared to have an accompanying paranoid syndrome. 84% of the paranoids were identified, 14% of which were determined to be paranoids with "organic" features.

#### Conclusions

The Wechsler-Bellevue and Rorschac were efficacious in differentiating paranoid schizophrenics from paretics, and in detecting psychosis in both groups.

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#### THE IMPACT AND AFTER-EFFECTS OF WAR ON A STATE PRISON SYSTEM

(Publication No. 1266)\*

Vernon Brittain Fox, Ph.D. Michigan State College, 1949

Wartime mobilization of aggression and increased activity in military and civilian population movement create an impact of war and certain after-effects on the State prison system as a social institution. The nature of the impact and the after-effects is illustrated by shifts during and after the war in types of crime for which persons were committed to prison, socio-economic areas from which they came, their attitudes toward war and patriotism, general personality adjustment, and the behavior of prisoners.

Commitment data were collected and tabulated to compare characteristics of persons committed to prison during prewar (1939), wartime (1943-1944), demobilitory-postwar (1945-1946), and postwar (1947) periods. Commitments to prison in Michigan were reduced during wartime principally among the white, Michigan-born persons with urban residence, and in the age range of 18 to 35 years. Increased commitments from Detroit and decreased commitments from agricultural and cutover areas were observed.

A significant increase during wartime in proportion of crimes against persons over that of prewar period was found. While this proportion decreased after the war, it did not return to prewar levels. Crimes of violence increased in proportion to non-violent crimes during wartime, decreased to prewar levels at time of demobilization, and rose again during the postwar period. Crime rates for women did not rise until the demobilitory period.

Intelligence quotients and performance on academic achievement tests of new prisoners received during wartime were found to be significantly higher than those of new prisoners received during prewar peacetime. This trend continued during the demobilitory-postwar period. Simultaneously, the grade-completed-in-school remained stable throughout the prewar and wartime periods.

Bernreuter Personality Inventories were given to 1,235 prisoners in 1944 and 500 prisoners in 1948. Postwar group scored significantly more unfavorably in neurotic tendency, introversion,

<sup>\*</sup> Microfilm copy of complete manuscript of 228 pages, \$2.85. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-66.

submissiveness and social inadequacy, and hampering self-consciousness.

Thurstone-type scales for measuring attitude toward war and toward the U.S. Constitution were administered to 500 prisoners in 1944 and to 500 prisoners in 1948. Scores indicated that wartime and postwar prisoners were mildly opposed to war and were neutral with regard to the Constitution. The wartime group tended significantly toward extreme attitudes more than did the postwar group. An attitude scale to measure willingness to enter military service was constructed primarily by Thurstone's method, and was given to the same prisoner groups in 1944 and 1948. Both groups were motivated primarily by desire to be free from prison, but wartime prisoners were more willing to enter military service for patriotic reasons.

Wartime mobilization of aggression and subsequent frustration by imprisonment makes it necessary for prisoners to find substitute satisfactions during wartime. These consisted of the following: Increased entertainment as a distraction device; increased prison industrial production, as a consequence of more efficient behavior; donations to servicemen and service organizations as substitute responses; editorial agitation for military service by prisoner papers as a 'talking it out' device; and substitute satisfactions in way of military drill.

## RESEARCH BASIS FOR A LOCAL COMMUNITY PROGRAM OF JUVENILE DELINQUENCY PREVENTION

(Publication No. 1215)\*

Alfred Michael Franko, Ed.D. New York University, 1949

This study was an investigation to ascertain, gather, and analyze the types of social data upon which to build a community program for the prevention of juvenile delinquency. The purposes of this study were five: First, to collect and to organize those basic data of a community which constitute the social milieu in which youth lives and which might afford some clues to the causation of juvenile delinquency; second, to determine the extent and nature of juvenile delinquency in a community; third, to ascertain and

<sup>\*</sup> Microfilm copy of complete manuscript of 885 pages, \$11.07. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-16.

appraise the efforts of the community in preventing delinquency and in rehabilitating the delinquent; fourth, to indicate to a group of local citizens the possible sources of pertinent data and the methods by which the data can be collected within a reasonable length of time and without the expenditures of vast sums of money; fifth, to indicate by an actual study of Peekskill, N. Y., the analysis of the data so that a community program for the prevention of juvenile delinquency can be formulated.

The data were gathered and classified under the following headings:

- 1. Economic and Sociological Background of the Community. Sources utilized: (1) Census reports on the growth and status of the population, on industries and occupations, retail trade, manufactures, housing, rentals, value of homes, status of repair of homes, and plumbing and toilet facilities; (2) Census, state, and county records on death and birth rates, incidence of tuberculosis and venereal diseases, and incidence of childhood diseases; (3) tax bills of Peekskill and other Westchester communities for a period of years; (4) maps in the Tax Assessor's office which showed the use of land and the value and distribution of different types of dwellings; (5) historical records including newspapers and publications of the Board of Trade.
- 2. Nature and Extent of Juvenile Delinquency. Sources and techniques utilized: (1) official records (case-studies, social histories, medical and psychometric examinations, reports of teachers, social workers, probation officers, and psychiatrists) of the Children's Court, the Municipal Court, and the County Court; (2) interviews with teachers, real-estate brokers, police, ministers, and local citizens; (3) periodic and systematic visits to taverns, bowling-alleys, motion picture houses and other places frequented by youth.
- 3. Leisure-Time Activities of Youth. Sources and techniques utilized: (1) School schedules filled out by every child in Peekskill public schools; (2) working permits issued; (3) visits to Depew Park, recreation and amusement centers.

4. Community Resources Available for a Program of Juvenile Delinquency Prevention. Sources and techniques utilized: (1) survey of all churches, schools, societies, clubs, agencies, and organized groups; (2) visits to these places.

The data revealed Peekskill to be a poor community with a very small wealthy group and a very large poor group. It is an extremely tax-conscious community not given to liberal expenditures for civic and social improvements. Only \$150 was spent in one year for a community "recreation" program. Recreation facilities were few in number and infrequently used. Over 60 per cent of the

youth of Peekskill belonged to no organized group. They spent their leisure time at work or at the movies. Proportionately, Peekskill had as many juvenile delinquents as New York City. Ninety per cent of them lived in the dilapidated areas adjacent to the central commercial-business center. Crimogenic factors were found to be: (1) lack of parental supervision; (2) culture conflict; (3) crowded homes; (4) excessive child labor with little or no law enforcement; (5) lack of recreational facilities in Peekskill; (6) presence of a large number of taverns in slum areas, all poorly supervised. Delinquencies consisted mainly of property damage, stealing, and disorderly conduct. Rehabilitation was hampered by lack of community youth organizations.

The suggested program was the establishment, under school control, of a centralized unit for the rendering, channeling, integration, and coordination of all special youth services. The duties of this unit (the Department of Attendance, Recreation, and Child Guidance) were so allocated as to meet the needs of all normal children and particularly of those most likely to become delinquent. A large Citizens' Advisory Council and a Youth Council were suggested to advise and assist the Department.

The study was made by a volunteer committee of ninety lay and professional citizens of Peekskill without any special training in sociological research methods and techniques.

## SOCIAL ORGANIZATION OF UPPER HAN HAMLET IN KOREA

(Publication No. 1245)\*

Chungnim Choi Han, Ph.D. University of Michigan, 1949

This is a case study of Upper Han Hamlet, 1920-1938, in the northeastern part of Korea. In making this study, the author views society as maintaining a state of equilibrium by the integration of numerous social patterns. Accordingly, the Hamlet is treated as a functioning unit which is comprised of several different patterns and the weaving together of these patterns receives considerable attention.

<sup>\*</sup> Microfilm copy of complete manuscript of 238 pages, \$2.98. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-46.

Upper Han is a clan hamlet and members of the Han clan comprise most of its population. Nearly all of the people are born and die there without having travelled to other than a few market places located within thirty ri (about 0.3 miles) of the Hamlet. The inhabitants are almost completely isolated from the outside world except for these market places where they trade with people from other villages.

The most important units of Hamlet society are family, clan, and age-group. The first two, which continue from one generation to another through the agency of the kinship system, provide the basis of cultural continuity. The age-groups bring about horizontal relationships which connect the different families into a functioning whole. It is the interpersonal relationships themselves that comprise the most important socio-cultural institutions of the Hamlet.

Interpersonal relationships are culturally patterned on the basis of the kinship system. This system appears to be very elaborate but, careful observation shows that the basic principles are age, generation and sex. It is not an arbitrary system, but has evolved from the life of the Hamlet and actual kinship is supplemented by other factors such as adoption, inheritance, and succession customs.

Even though the Hamlet recognizes two important lineages, patrilineal and mother's patrilineal, it is only the former that provides the basis for post-marital residence units. The patrilineal lineage also governs the behavior patterns of individuals belonging to the same clan. Members of an older generation have a higher prestige than those of younger generations; males are more important than females; and older persons have more authority over various matters than younger members of the same generation. Among persons other than relatives, too, age and sex play important roles in determing one's behavior; and sex dichotomy is carefully preserved throughout the society.

Established patterns of interpersonal behavior are strictly observed by all in economic, social, and religious activities, such as life cycle functions, agricultural and trading practices, and seasonal festivities. Through participation in these various activities members of the Hamlet learn to behave properly; and by observing the rules the equilibrium of society is maintained.

Various customs attendant on birth, marriage, death, ancestor worship, and the day-to-day work of providing food and shelter, are all essential parts of the Hamlet's culture. The slightest change, therefore, in any of these behavior systems results in a somewhat altered total pattern, and any departure from established custom must be integrated into the entire structure of Hamlet society.

A STUDY IN LAW AND SOCIAL DIFFERENTIATION: AS EXEMPLIFIED IN VIOLATIONS OF THE EMERGENCY PRICE CONTROL ACT OF 1942 AND THE SECOND WAR POWERS ACT, IN THE DETROIT WHOLESALE MEAT INDUSTRY

(Publication No. 1246)\*

Frank E. Hartung, Ph.D. University of Michigan, 1949

Emile Durkheim, in On the Division of Labor in Society, advanced the hypothesis that civil law may be taken as an index of social differentiation. In his analysis of social organization, Durkheim distinguished two general types of social structure. In the first type, consensus exists, so that the members of the society tend to behave similarly in similar situations. In the second type, consensus still exists, but free-standing groups have developed which are largely emancipated from this consensus in respect to conditions with which they are especially concerned. There is thus a societal condition in which all persons tend to behave similarly in certain similar situations, and differently in certain other similar situations. Civil laws tend to accompany the development of differentiated groups, and may be considered as an index of this differentiation.

A direct test of the hypothesis was attempted. With the permission and cooperation of the Office of Price Administration, all of the files on the wholesale meat industry in the Detroit District Office were read. From these, five cases each of criminal and civil violations were selected and summarized, omitting any indication as to criminal or civil violation. The reaction of a random sample of 600 Detroit adults and forty meat wholesalers was obtained to these summaries, in a degree-of-disapproval test, and in a ranks test.

In the former test, each respondent indicated his reaction to each violation, on a five-point scale: strongly approve, approve, uncertain, disapprove, and strongly disapprove. In the ranks test, the respondent ranked the cases according to his estimate of their seriousness.

The public was divided into four sub-groups: age, sex, occupation, union membership. Its reactions were tabulated according to

<sup>\*</sup> Microfilm copy of complete manuscript of 373 pages, \$4.67. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-46.

these groups, and statistically compared to the reactions of the wholesaler group. The following similarities and differences were found, and were interpreted as constituting at least a partial confirmation of Durkheim's hypothesis:

- 1. The public tended to disapprove equally both the criminal and civil cases.
- 2. The public and the industry tended to disapprove the criminal cases equally.
- 3. The public and the industry tended to differ significantly in the disapproval of civil cases.
- 4. The industry tended to differ significantly in its disapproval of criminal and civil cases.

This study has significance for criminology in at least two ways. First, it has a direct bearing upon current studies of criminality. These studies must be qualified to the extent to which they claim:

- 1. to be based upon an adequate sample of known offenders;
- 2. to offer an empirical basis for a general theory of criminality; and
- 3. to describe the characteristics of known offenders.

Secondly, this study calls into question the customary limits of the field of criminology. It demonstrates

- 1. the absence of logical criteria by means of which to judge the consequences of violations calling for civil process, in contrast to those calling for criminal prosecution: and
- that a significant proportion of criminal offenses are concealed behind civil process — the choice of civil rather than criminal proceedings being dictated in these cases by extralegal considerations.

#### A LAND USE SEQUENCE STUDY OF THE DORT HIGHWAY AREA, FLINT, MICHIGAN

(Publication No. 1247)\*

Noland Rall Heiden, Ph.D. University of Michigan, 1949

The study traces the sequence of land use in the vicinity of the A. C. Spark Plug Dort Highway Plant, in order to estimate what

<sup>\*</sup> Microfilm copy of complete manuscript of 116 pages, \$1.45. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-47.

may be expected to happen near the new Chevrolet Assembly Plant. The study is divided into four parts. First, there is a survey of the development of Flint from 1859 to the present, which deals with the distribution of commerce, industry, and population, and with the rate of population growth. The second and third parts contain respectively an analysis of the land use sequence in the Dort Highway Area before and after the construction of the A. C. Plant. The final section concerns the application of this study's findings to the area about the new Chevrolet Plant.

In tracing the effects of the A. C. Plant two areas were selected, called the Experimental and the Control, similar in all major respects except for the existence of the A. C. Plant in the former. In order to isolate this one main variable the following controls were established: 1. Similar surface drainage; 2. Similar land use; 3. Similar transportation arteries into the city; 4. Similar dates of incorporation; 5. Similar zoning restrictions. The Control Area serves as a means by which the effect of the A. C. Plant upon the Experimental Area is estimated; by comparing the sequence of development for both areas it is possible to determine what differences occur between the areas. The areas are mapped and examined at seven periods ranging from 1907 to 1946; they are compared on the basis of development in definite land use categories including residential, light and heavy commercial, industrial and public.

There were found to be differences in the amount of land devoted to the various land use categories; in the direction of development; in the rate of development; in the development of utilities;

and in the level of assessed land values.

Combining these findings with the fac

Combining these findings with the factors of similarity and dissimilarity between the locations of the A. C. Plant and the new Chevrolet Plant, it has been concluded that the following developments may occur in the vicinity of the new Chevrolet Plant: 1. The combination of plant, highway and railroad may attract other commercial and industrial establishments, with the result that a wedge of land in industrial and commercial use may develop along the Grand Trunk Railroad and 12th Street; 2. Good residential development in the area will be possible if accompanied by adequate planning; 3. Residential development will occur between the Plant and existing built up areas, with the area between the Plant and Fenton Road appearing the most likely place for future development.

#### THE COOPERATIVE COMMONWEALTH FEDERATION IN SASKATCHEWAN: A SOCIAL MOVEMENT

(Publication No. 1288)\*

Marion Arthur Waggoner, Ph.D. University of Missouri, 1946

This thesis is a study of the Cooperative Commonwealth Federation of Canada as a social movement. A comparison is made between the C. C. F. and certain other social movements that have appeared in the history of the United States. Considerable attention is given to the social and economic disorganization that preceded the C. C. F. with emphasis directed toward the province of Saskatchewan. Long continued economic insecurity and hardship following World War I created a growing social unrest. This unrest with its attendant farm and labor protest organizations culminated in 1933 in the organization of the C. C. F. at Regina, Saskatchewan. The movement grew slowly and achieved its first major victory by gaining 47 of 52 seats in the Saskatchewan Legislature.

The ideological structure of the C. C. F. movement is based upon the Regina Manifesto which was adopted at the first convention in 1933. According to this proclamation the fundamental aim of the C. C. F. is to establish in Canada a cooperative type of commonwealth based upon economic planning which will replace unregulated private enterprise and economic competition. Natural resources and the principle means of production and distribution are to be socialized. Farm land and smaller business enterprises are to remain under private ownership. This social and economic transformation is to be accomplished by political action.

Attention is given to the leadership of the C. C. F., including that of Woodsworth, Coldwell, Douglas, and the local group leaders of the Cooperative Commonwealth Youth Movement. An analysis is made of the leadership of these individuals in the terms of the types of leaders and of the techniques used by them.

Accomplishments of the new movement in the province of Saskatchewan during the period of 1944-46 have been described in some detail. Since the movement contains laborers as well as farmers in its membership, the legislative program during this

<sup>\*</sup> Microfilm copy of complete manuscript of 290 pages, \$3.63. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-88.

period has included several significant measures for the benefit of the worker as well as broad agricultural legislation. Important legislative acts studied were The Trades Union Act, The Annual Holidays Act, and the Farm Security Act.

An extensive health program has been established by the Saskatchewan Government, including a public health plan, medical service for certain groups at government expense, health insurance, and an air ambulance service for the rural regions.

The cooperative movement has been encouraged by the Saskatchewan C. C. F. government in several ways. A new Department of Cooperation and Cooperative Development has been established and a government research service made available to all cooperative groups in the province.

Education has been improved by consolidation of rural districts, financial grants to low standard schools, and scholarships for teacher training.

A significant development has been the creation of eleven Crown corporations. These government owned industries include a brick plant, bus lines, box factory, a leather goods industry, and various other enterprises. The government corporation is a direct step toward the ultimate objective of the C. C. F., the cooperative commonwealth. Up to the present time (1946) the Crown corporation system is in its earliest phase of development. All of the Crown corporations have a relatively small productive capacity and few employees.

Opposition to the C. C. F. is in a formative stage. Large business interests are as yet unorganized in their fight against the new socialist movement. The privately owned newspapers of Canada are persistent opponents but the most bitter attacks have come from certain individual Canadian citizens representing special economic or political interests. It is rather certain that in the future the C. C. F. will face a determined and formidable opposition organized around the large private businesses of the Dominion. In the political field the opponents are the Liberal, Conservative, and Communist parties.

There are implications in this socialist movement for the United States. Under conditions of drouth and economic depression a similar protest organization could easily appear in this country. The future of the C. C. F. in Canada will probably be largely determined by future economic conditions. Depression might be disastrous for it, or, on the contrary, such a crisis might act to further integrate and strengthen the movement.

#### LIMNOLOGICAL RELATIONS OF INSECTS TO PLANTS OF THE GENUS POTAMOGETON

(Publication No. 1185)\*

Clifford Osburn Berg, Ph.D. University of Michigan, 1949

Limnological relations of insects to plants representing 17 species of Potamogeton were studied in 5 counties in the Lower Peninsula of Michigan.

Insects of 42 species reared from Potamogeton are listed and the host plants of each recorded. Approximately 64 per cent of this fauna is phytophagous; the remainder includes parasites, insects protected by living within Potamogeton tissues, and insects which draw oxygen from these plants.

The identified insects directly related to Potamogeton belong to 32 species, including 17 species of Diptera (chiefly Chironomidae and Ephydridae), 6 species of Trichoptera, 4 of Lepidoptera, 3 of Coleoptera, and 2 species of Homoptera. Odonata (Zygoptera and Anisoptera) unidentified beyond sub-order and representing an unknown number of species hatched from eggs found within the plants. Parasitic Hymenoptera of 10 species, at least 6 of which remain undescribed, were reared from the insects directly related to Potamogeton.

The total number of species of insects found associated with each plant is as follows: P. alpinus, 13; P. amplifolius, 25; P. epihydrus, 6; P. filiformis, O; P. foliosus, 2; P. Friesii, 1; P. gramineus, 10; P. illinoensis, 5; P. natans, 23; P. nodosus, 6; P. Oakesianus, 3; P. pectinatus, 1; P. praelongus, 10; P. pusillus, 0; P. Richardsonii, 18; P. Robbinsii, 6; P. zosteriformis, 7.

Plants of the genus Potamogeton suffer injuries of various types due to infestation by these insects. The phytophagous species mine, channel, skeletonize or entirely consume leaves; burrow in, or gnaw away superficial patches of stems, roots, or flowering peduncles; or suck plant juices. Injuries from insects seeking shelter within plant tissues include stem-burrows of Chironomidae larvae, punctures from ovipositors of Odonata, and defoliation by casemaking larvae of Lepidoptera and Trichoptera. Larvae of Ephydridae (Diptera) and Donaciinae (Coleoptera) pierce the epidermis when they insert their respiratory spines to obtain oxygen.

<sup>\*</sup> Microfilm copy of complete manuscript of 185 pages, \$2.32. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-394.

The biology of insects found associated with <u>Potamogeton</u> is treated in some detail. Various degrees of aquatic adaptation are illustrated by <u>Potamogeton</u> insects. Representatives of most of the species studied hibernate as larvae, on or within host plants living beneath the ice. Striking differences in local population densities of the insect fauna are presented. The Chironomidae are classified here into 3 groups on the basis of their relations to the plants.

Immature stages of certain species are described and illustrated for the first time. Attention is given to early stages representing 7 species of Diptera recently described from specimens reared in connection with this investigation and to those of some other species the adults of which were described previously. A key is presented to larvae and puparia of Hydrellia (Ephydridae) found on Potamogeton.

Potamogeton species support a large and heterogeneous assemblage of insects which are directly, intimately, and in some instances probably obligatorily related to these plants.

## AGE AND GROWTH OF THE BROOK TROUT, SALVELINUS FONTINALIS (MITCHILL), IN MICHIGAN

(Publication No. 1240)\*

Edwin Lavern Cooper, Ph.D. University of Michigan, 1949

The examination of scales from fish of known age proved the method of determining the age of brook trout by counting the numbers of annuli on their scales to be valid. Analysis of the age-composition of several populations of trout in Michigan revealed that only a few of this species live longer than 3 years. This brevity of life span was attributed to a combination of two factors: (1) high fishing intensity for the species, and (2) an inherent lack of wariness on the part of the brook trout. The maximum age of this fish in Michigan is about 8 years; that this figure also holds for other regions, is substantiated by published data.

The feasibility of calculating previous growth history of the brook trout by means of scales was established by extensive study of the body-scale relationship. In all populations investigated, the

<sup>\*</sup> Microfilm copy of complete manuscript of 144 pages, \$1.80. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-40.

body-scale ratio was different and deviated significantly from a straight line. Errors arising from the assumption of a straight-line relationship between body length and scale length are considerable. However, the use of a "general" body-scale curve for all localities is practical.

The rate of growth of brook trout based on calculated lengths at completed years of life exhibited great diversity among different populations. Differences in growth rate due to sex were rare and small. The amount of growth was much the same from one calendar year to another in any one locality. Hook-and-line fishing was highly selective in harvesting the faster growing members of each age-group of brook trout in two lakes. The appearance of Lee's phenomenon of "apparent change of growth rate" in a lake population was attributed to continuous operation of hook-and-line selectivity.

Periodicity is a characteristic of growth in brook trout. Nearly all of the yearly increment in length accrued from April through August. Average actual lengths at completed years of life as determined in a detailed study of seasonal changes in growth rate agreed well with average lengths calculated from scale measurements.

The length-weight relationship, as determined from all available data from brook trout in different localities in Michigan, is described adequately by a cubic parabola. A study of possible variations in weight due to such factors as sex, season, and size was precluded by the heterogeneity of the samples.

Better management of the brook trout fishery in Michigan is possible through individualized regulation of different waters. Local regulations of the fishery should be based on a knowledge of population density, growth characteristics, and the rate of exploitation by fishermen.

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# REPRODUCTION AND MIGRATION OF THE YELLOW PIKEPERCH, STIZOSTEDION VITREUM VITREUM, IN MICHIGAN

(Publication No. 1188)\*

Paul Henry Eschmeyer, Ph.D. University of Michigan, 1949

The reproductive behavior of the yellow pikeperch, Stizostedion vitreum vitreum (Mitchill), was observed during four seasons on wave-swept shoals along the leeward east shore of Lake Gogebic. Adult fish began to appear soon after the break-up of the ice, in late April or early May, and were present in varying numbers. ranging to more than 22,000, for the following three or four weeks. Predominantly, spawning occurred at night in less than three feet in depth, within a few yards from shore, over a bottom of mixed gravel, rubble and boulders. Females were observed to broadcast their eggs in the company of one or (usually) more males. There was a marked predominance of males on the spawning beds throughout the season. They were the first to arrive and large males remained on the area for a number of days after the females had left. Spawning males exhibited no established territoriality, but showed a general movement in both directions along the shoals for distances as great as five miles. Recaptures of marked fish on the spawning beds were at intervals as great as 13 days. Pikeperch dispersed widely in the lake following spawning.

Ovaries of pikeperch just before spawning averaged from 17.3 to 27.9 per cent of the body weight. For 34 specimens from Lake Gogebic ranging from 16.0 to 22.7 inches in length the average egg production was 28,500 per pound of fish; for 16 larger fish from Muskegon River and from Saginaw Bay this average was over 41,000. Residual eggs comprised 0.3 per cent of the estimated egg production in 5 out of 6 spent pikeperch examined. The percentage of viability of eggs in collections made in three lakes during the spawning season ranged from 17 to 72.

Young pikeperch leave shoreward areas soon after hatching and probably lead a pelagic existence until they are about an inch or more in length, re-entering the shoals in late June or early July. At this time they may be participating members of perch schools

<sup>\*</sup> Microfilm copy of complete manuscript of 246 pages, \$3.08. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-397.

or may form schools of their own. After early August they are usually found in areas sheltered by vegetation or in deep water, rather than on the shallow, barren, sandy shoals which they occupy earlier. In 1947, young pikeperch attained a length of 4.7 inches at the end of the growing season. Their principal food was young yellow perch.

Yellow pikeperch ascending the Muskegon River on their spawning migration from Lake Michigan encounter Newaygo Dam, an impassable barrier, at a point 39 miles above the mouth of the river. During the past 21 years an average of 9,300 pikeperch per year has been caught in dipnets in the river below the dam and transferred to five upstream impoundments and certain other waters. Returns from 1,375 tagged pikeperch transferred in 1947 and in 1948 revealed extensive downstream movement. This was for distances as great as 137 miles and involved the passing of as many as three power dams.

EARLY DEVELOPMENT OF THE LARGEMOUTH BLACK BASS, MICROPTERUS SALMOIDES SALMOIDES (LACEPEDE), AND THE HISTORY OF THE GERM CELLS THROUGH THE PERIOD OF SEX DIFFERENTIATION

(Publication No. 1249)\*

Perry Max Johnston, Ph.D. University of Michigan, 1949

This dissertation comprises a study of the early developmental history of the largemouth black bass and of its germ cells. The initial object of the investigation was to trace the history of the germ cells from the time of their earliest recognition up to the time of their inclusion in the gonad and through sex differentiation.

Because of the lack of authentic information regarding the early embryology of teleosts it was found necessary first to make a thorough study of the developmental history of the animal. The dissertation, therefore, is divided into two parts, the first dealing with embryogeny and the second with the history of the germ cells.

Study was made of over 2000 microscopic preparations from the early blastoderm to the six centimeter stage. No new techniques were developed.

<sup>\*</sup> Microfilm copy of complete manuscript of 172 pages, \$2.15. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-49.

A résumé of some of the literature dealing with germ cells in vertebrates is given in Part II. That concerned primarily with fishes is discussed briefly. Several new observations and relationships are described. These are: The formation of a caudal extension of the yolksac; the piling up of potential germ cells at the dorsal lip of the blastopore; their migration and later inclusion in the caudal extension of the yolksac; and their further migration through the potential coelom.

The following conclusions were reached regarding the early development of the bass: A true discogastrula is formed without either an archenteron or blastocoel; the germ ring is homologous to the lips of the blastopore; gastrulation results from cell movements and not from differential mitotic activity or delamination; the ectoderm consists of epidermal and nervous strata; the invaginated mesentoderm delaminates into mesoderm and entoderm; Kupffer's vesicle arises as a part of the gut and becomes the cloaca; a caudal extension of the yolksac accompanies the growth of the tail.

Observations on the history of the germ cells justify the following conclusions: The primordial germ cells are set aside early in development; the germ cells are first recognized in the excrescence at the dorsal lip of the blastopore; they possess no distinctive structural features by which they can be recognized and they can be identified only by size and in the light of their future migration and history; the germ cells migrate by amoeboid movement; after migrating from the excrescence they are first housed in the periblast and later migrate out of the caudal yolksac extension into the potential coelom, thence dorsad around the gut, through the mesentery, and laterad to the germ gland primordia; the migration path is determinate; no lost or strayed germ cells found; the gonads possess a gonocoel made patent by delamination of the gonadal epithelium; the gonads are paired anteriorly and fused posteriorly; the ovary shows a lamellar structure and the testis a tubular structure; no germinal epithelium is formed; the germ cells lie against but not in the epithelium covering the gonads; sex is distinguishable at the 3.0-centimeter stage; no transformation of stromal or epithelial cells into germ cells occurs; the definite sex cells are derived only from the primordial germ cells.

## FACTORS CONDITIONING THE GROWTH OF FOLLICLES AND OVULATION IN THE BAT MYOTIS GRISESCENS

(Publication No. 1287)\*

Elizabeth W. Smith, Ph.D. University of Missouri, 1946

The mechanism of hypophyseal-ovarian interaction is approached through a study of the factors affecting the follicleoocyte system of the ovary. A complete census of the growing follicles and those in early stages of regression is made in untreated bats and in those in which the level of gonadotrophin, thyroxin, and cortin is varied in animals collected at intervals from June through November. The bat has neither a postpartum estrus nor an anestrum. Animals enter diestrum immediately after parturition in June and proestrum probably begins the latter part of August. The onset of estrus is about the middle of September and it continues at a submaximal level during the hibernation period. At different periods of the estrous cycle variations are observed in the number of growing follicles, the volume of the follicle-oocyte system, the diameter of the largest follicles, and the number of regressing follicles. The number of follicles is greatest during lactation in July, but the volume of the follicle-oocyte system does not reach its peak until proestrum in late August. The amount of regression is maximum in September when the volume of the follicle-oocyte system is decreasing. The diameter of the largest follicle increases continuously from June through November. No significant correlation exists between the number of follicles and the volume of the follicle-oocyte system within an ovary. Although the number of follicles decreases with age, the volume of the follicle-oocyte system increases.

Lateral asymmetry is found in the ovaries as well as in the uterus. The right uterine horn is larger than the left. The volume of the follicle-oocyte system is greater in the ovary containing the vesicular follicle which tends to develop in the right ovary after stimulation with PU. The growth of the oocyte in relation to the growth of the granulosa varies with the period of the estrous cycle and with age but it is not affected by injections of PU. The oocyte grows most slowly in newborn bats and most rapidly in mature bats

<sup>\*</sup> Microfilm copy of complete manuscript of 316 pages, \$3.95. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 49-87.

at the beginning of estrus in late September. With respect to the volume produced, the responsiveness of the follicle-oocyte system reaches a peak in late August. With respect to ovulation the responsiveness of the follicle-oocyte system increases throughout the estrous cycle. Ovulation can be induced as early as September 26, six months before its normal occurrence, by injections of PU. Ovulation occurs when the volume of the follicle-oocyte system is low and when there is a discontinuity near the upper limits of the follicle size range. In hibernating bats in November ovulation is induced in 100% of the animals treated with PU, in 100% treated with PU and cortin, and in 70% treated with PU and thyroxin. The follicle-oocyte unit is responsive to gonadotrophin at all levels of growth and differentiation although the responsiveness is greatest in the vesicular follicles. A single gonadotrophin, present in varying quantity throughout the reproductive cycle, seems adequate to explain the observed reactions of the follicle-oocyte system in the bat.

# A COMPARATIVE LIFE HISTORY STUDY OF THE DOWNY AND HAIRY WOODPECKERS (DENDROCOPOS PUBESCENS AND DENDROCOPOS VILLOSUS)

(Publication No. 1260)\*

Arthur Eugene Staebler, Ph.D. University of Michigan, 1949

This is a study of the relationships between the Downy and Hairy Woodpeckers as indicated by their life histories. These woodpeckers are regarded here as sibling species. The differences and similarities in habits and behavior were studied in an effort to determine their possible influences on the past, present and future biology of these two birds.

The study is based largely on observations made of the living birds in the field. Field work was limited chiefly to the 1,300 acre Edwin S. George Reserve, 20 miles northwest of Ann Arbor, Michigan. Field work was conducted from February, 1940, through July, 1942, and from July, 1946, through August, 1947. Approximately 1,200 hours were spent in field observations.

During the winter months attempts were made to capture as many as possible of the Downy and Hairy Woodpeckers on the

<sup>\*</sup> Microfilm copy of complete manuscript of 234 pages, \$2.93. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A49-60.

Reserve. Hand operated traps baited with suet were used to catch them. Birds were released after capture as soon as they were banded with aluminum Fish and Wildlife Service leg-bands and certain colored celluloid leg-bands. Each bird was given its own distinctive color combination of bands. A total of 72 adult Downy and 10 Hairy Woodpeckers was marked in this manner.

The marking of the birds made it possible to follow individuals throughout entire breeding seasons and in many cases over a period of several years. Detailed information regarding the pair formation, courtship and behavior of individuals was thus obtained. Observations were made at the nests of both species and details of their nesting activities noted. When possible, the young in the nests were color-banded and their movements after fledging recorded.

The conclusions reached are that the great similarity exhibited by the two species in nearly all of their habits and behavior indicates a very close genetic relationship. There is no interspecific competition between them for nesting territories, nesting sites, food or wintering areas. Neither species is migratory. In the area studied and probably in most of eastern North America, the Downy Woodpecker is the more successful species and has been better able to maintain itself in the present countryside environment as created by man than has the Hairy Woodpecker. Evidence indicates that the Downy and Hairy Woodpeckers evolved from a common ancestor and that their close similarity is not the result of convergent or parallel evolution or of mimicry.

## POPULATIONS AND HOME RANGE RELATIONSHIPS OF THE BOX TURTLE, TERRAPENE CAROLINA (LINNAEUS)

(Publication No. 1177)\*

Elizabeth Lucille Farrier Stickel, Ph.D. University of Michigan, 1949

A population study of <u>Terrapene carolina</u> (Linnaeus) was made at the Patuxent Research Refuge, Maryland, from 1944 to 1947.

A thirty acre area in bottomland forest was selected for intensive study. Turtles were marked by filing notches in marginal scutes according to a code.

Turtles make extensive use of brushy shelter during the day as well as at night. Gully banks and woods openings are used for

<sup>\*</sup> Microfilm copy of complete manuscript of 153 pages, \$1.92. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-386.

sunning.

Nights are usually spent in a "form," constructed by the turtle in leaves, debris, or earth. A form may be used once or it may be used repeatedly by the same or different turtles.

Weather conditions most favorable to turtle activity are high humidity, warm sunny days, and frequent rains. Periods of activity are alternated with periods of quiet, even in favorable weather.

There is no evidence for territorialism. Ranges of turtles of all ages and both sexes overlap grossly. Turtles are frequently found near each other but no antagonistic behavior has been observed.

Adult turtles occupy specific home ranges which they maintain from year to year. Turtles retained their ranges even though a flood that completely covered the study area.

Maximum home range diameters were determined by measurements of the mapped ranges of individual turtles. There was no significant difference between sizes of male and female ranges: males 330± 26 feet, females 370+29 feet.

A trail-laying device was used in following travel routes for 456 turtle days. Normal movements within the home range are characterized by (1) turns, doublings, detours, and criss-crossing paths, (2) interspersion of fairly direct traverses of the home range, (3) frequently repeated travels over certain routes.

Maximum limits of the home range are ordinarily reached within a few days or weeks, although some turtles cover only one portion of the range at a time.

Some turtles have two home ranges. One of these turtles was followed with a trailer for 161 days in 1946 and 1947.

Trips outside the home range are made by females for egg laying. Trips of unexplained nature are made by both males and females. Turtles from other areas are occasional transients through the study plot.

Standardized census trips provided data for estimating the size of the population. Census data were taken after females had returned from egg laying. The samples were spaced at intervals of a week or more to allow free movement of turtles over their ranges and assure more nearly equal availability of all turtles.

These standard samples were compared by a collection ratio. Assumptions involved in the use of this ratio are discussed. Correction factors were applied to make allowance for turtles whose ranges were partly inside and partly outside the study area, and for transient turtles. A second estimate, on the basis of the entire season's collecting, gave closely comparable results.

The population of the study area is estimated to be between four and five turtles per acre, with juveniles constituting less than ten per cent of the total.

#### PART II

MONOGRAPHS

#### DIGESTA ANTI-SHAKESPEAREANA

(Publication No. 1175)\*

Joseph S. Galland, Ph.D. University of Wisconsin, 1914

Digesta anti-Shakespeareana, a descriptive bibliography of books and articles on the various controversies concerning the authorship of the plays and poems usually ascribed to William Shakespeare, was prepared by Professor Joseph S. Galland, former chairman of the Department of Romance Languages of Northwestern University, and was nearly ready for publication at the time of his sudden death in November, 1947. After Professor Galland's death, his son-in-law, Professor Burton A. Milligan, of the University of Illinois, undertook the task of preparing the manuscript for publication. He copyread the work to eliminate obvious typographical errors, numbered the items listed, and prepared an index. Because of the high costs of printing, publication of the work in book form was not possible, even with the aid of a subsidy from Northwestern University. The University thereupon paid the cost of having copies of the manuscript microfilmed for the use of scholars in some of the leading libraries of America and Europe.

The entire manuscript consists of 1663 double-spaced typewritten pages, not including a brief introduction, but including an index of twenty-three pages. The work is a result of many years of research. In its compilation full use was made of the facilities of such leading libraries as the Folger Shakespeare Library, the Library of Congress, the Boston Public Library, the Libraries of Harvard University, the New York Public Library, the Newberry Library, the University of Chicago Libraries, the University of Pennsylvania Library, and the Charles Deering Library of Northwestern University. The compiler consulted earlier bibliographies on the subject, unpublished manuscripts, scrapbooks, books, magazines, and newspapers. The list includes not only English and American books and articles on the authorship controversy, but also works in German, French, Italian, Dutch, and other languages - many things, in fact, which were published as late as 1946. The 4509 items are listed alphabetically by authors; and most of them - those which Mr. Galland was able to examine - are described in

<sup>\*</sup> Microfilm copy of complete manuscript of 1667 pages, \$20.84. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 48-384.

considerable detail by use of summary, paraphrase, and quotation. Often, when he does not provide a summary, he indicates that an article or book is "pro-Bacon" or "pro-Shakespeare," or that it has some other definite viewpoint. Whenever he could he has given the place and date of publication of reviews of the books and articles listed, and sometimes he quotes significant comments from the reviews.

Although entitled <u>Digesta anti-Shakespeareana</u> and concerned principally with works attacking Shakespeare's authorship, the bibliography also lists and describes many articles and books which defend Shakespeare's authorship. All the known theories in support of non-Shakespearean authorship are fully represented. Among these are numerous entries which advance the claims of the following writers: Francis Bacon; William Stanley, Earl of Derby; Ben Jonson; Christopher Marlowe; Edward de Vere, Earl of Oxford; Sir Walter Ralegh; Roger Manners, Earl of Rutland; and Edmund Spenser. Throughout the work Mr. Galland's attitude is objective: He lists and describes the works printed on the subject, but he neither defends nor attacks any of them.

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# PART III

CUMULATIVE INDEX

# CUMULATIVE INDEX OF TITLES

The following pages contain the titles of all doctoral dissertations available on microfilm, excepting those abstracts in this booklet, which have been published since the appearance of Volume VI, No. 2 of MICRO-FILM ABSTRACTS (Dec. 1947). Abstracts of the following dissertations have been published in MICROFILM ABSTRACTS and in special volumes prepared for Pennsylvania State College and Colorado State College of Education. All may be identified by the letters and date following the reference.

- (M.A. ..) Microfilm Abstracts, University Microfilm, Ann Arbor, Michigan.
- (P.S. ..) Abstracts of Doctoral Dissertations. Pennsylvania State College, State College, Pennsylvania.
- (C.S. ..) Abstracts of Field Studies for Degree of Doctor of Education, Colorado State College of Education, Greeley, Colorado.

Positive microfilm copies of the complete manuscript of any of these titles may be had at 1-1/4¢ per page, or paper enlargements, 8-1/2 x 11 inches accommodating two pages each, at 10¢ per page, from University Microfilms, Ann Arbor, Michigan. Order should be made by "Publication Number," and Title.

# AGRICULTURAL AND BIOLOGICAL CHEMISTRY

Nutritional adequacy of rations high in corn content. William Thomas Burnett, Jr., Ph. D. Thesis; Pennsylvania State College, 1948. pp. 79, Pub. 1305. (P.S. 1948, Vol. XI)

A study of the vitamin A content of vitamin A standards and of representative fish oils by spectrophometric and biological methods of assay and a calculation of their respective conversion factors. Herman A. Ellenberger, Ph.D. Thesis; Pennsylvania State College, 1948. pp. 127, Pub. 1310. (P.S. 1948, Vol. XI)

An evaluation of some methods used in determining the thiamine content of meat and meat products. Oliver B. Fardig, Ph.D. Thesis; Pennsylvania State College, 1947. pp. 113, Pub. 1009. (P.S. 1947, Vol. X)

Preparation, purification and refractive index determinations of the methyl, propyl, and isopropyl esters of some saturated fatty acids. George William Hunter, Ph.D. Thesis; Pennsylvania State College, 1946. pp. 94, Pub. 915. (P.S. 1946, Vol. IX)

The synthesis of certain quaternary and chlorinated derivatives of pyradine and their fungicidal, bactericidal and insecticidal properties. Joseph C. LoCicero, Ph.D. Thesis; Pennsylvania State College, 1948. pp. 124, Pub. 1321. (P. S. 1948, Vol. XI)

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Vitamin D requirement of turkey poults. William Jacob Stadelman, Ph. D. Thesis; Pennsylvania State College, 1948. pp. 93, Pub. 1333. (P.S. 1948, Vol. XD

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